INDIA RUBBER WORLD

FEBRUARY, 1946

TECHNOLOGY DEPT.
DETROIT

Another CABOT Product

Pine Tar
FOR THE
RUBBER INDUSTRY

LIGHT - PT 400
MEDIUM - PT 600
HEAVY - PT 800

GODFREY L. CABOT, INC.
RETORT CHEMICAL DIVISION
SALES OFFICE, BOSTON, MASS.
PLANT, GAINESVILLE, FLORIDA

DU PONT

NEWSLETTER No. 2, FEB. 1946

RUBBER CHEMICALS DIVISION

PUBLISHED BY E. I. DU PONT DE NEMOURS & CO. (INC.), WILMINGTON 98, DELAWARE

BARAK—ACCELERATOR ACTIVATOR

BARAK is unique in its effect on GR-S stocks. While it is completely inactive when used by itself, even in arge amounts, it is a strong activator for acidic accelerators. Barak is an excellent activator for 2-MT and for all of the thiazoles, but it appears to be of most value when used in conjunction with MBTS.

AMOUNT TO USE: To obtain the highest efficiency from the combination, it is desirable to use a relatively high ratio of Barak to MBTS. In a GR-S stock containing easy processing channel black, a combination of 0.5 to 0.75 part Barak with 0.75 to 0.5 part of MBTS is usually preferred. The use of Barak results in stocks having a flatter cure and vulcanizates having both a high degree of resistance to crack growth and to deterioration on heat aging.

OUTSTANDING PROPERTIES: Chemically, Barak is dibutyl ammonium oleate. Being a non-accelerator of vulcanization, Barak is inherently non-persistent in GR-S. Its relatively strong activating effect on MBTS permits maintenance of a fast rate of cure in the presence of relatively small amounts of the thiazole accelerator as is shown in chart opposite. The faster rate and higher state of cure obtained by Barak activation are indicated by the higher modulus and the smaller change in all properties with extended cure. The decrease in heat build-up further substantiates this fact.

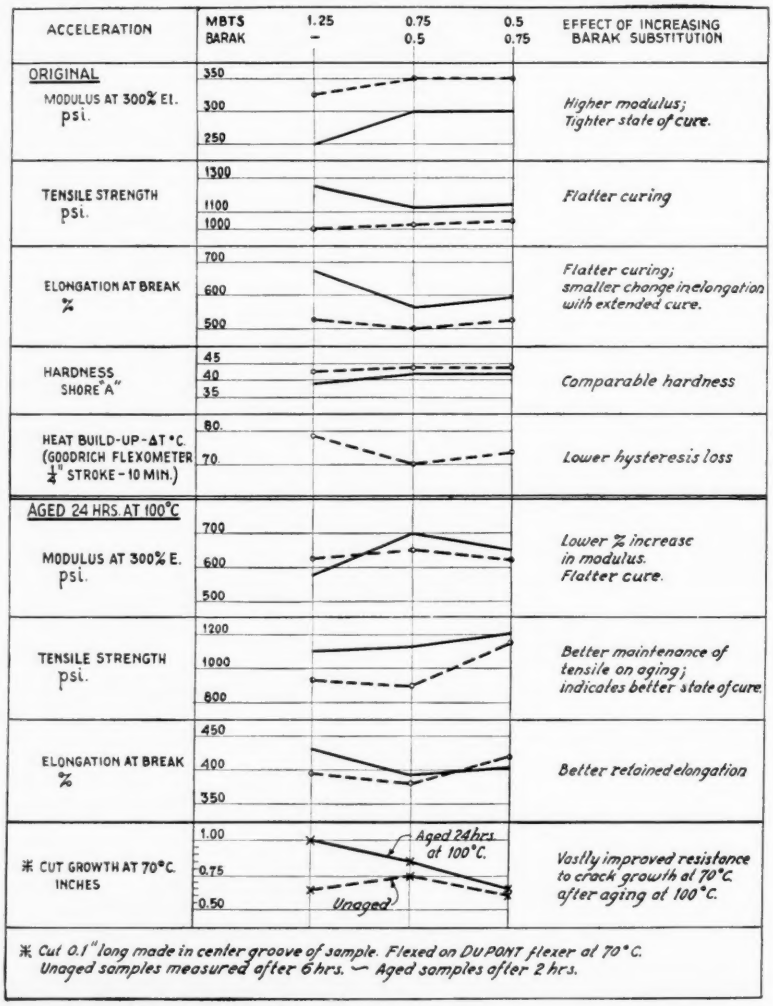
A consistent improvement in properties after aging at 100° C. is obtained by increasing the ratio of Barak to MBTS. The effect of Barak on resistance to crack growth after aging is outstanding. While the stock accelerated with straight MBTS cracked the full one-inch width in 2 hours when flexed at 70° C., the substitution of Barak for increasingly large amounts of the MBTS caused a proportional reduction in crack growth. As shown, the substitution of MBTS 0.5–Barak 0.75 for MBTS 1.25 parts reduced crack growth by 40 per cent.

USES: This is only one of the many uses of Barak. From the chart shown here it will be observed that the characteristics which it imparts to a vulcanizate suggest a multitude of uses in all types of products. Prior to the war it was extensively used as an activator in crude rubber and no doubt you will wish to keep it in mind as the availability of crude increases.

THE EFFECT OF BARAK ACTIVATION OF MBTS IN A GR-S STOCK

Base Compound	
GR-S	100.
Sulfur	2.
E.P.C. Black	20.
Softener	8.
Zinc Oxide	3.
Accelerator	As indicated

KEY — CURE
——— 60 min. at 280° F.
— — — 90 min. at 280° F.



* Cut 0.1" long made in center groove of sample. Flexed on DU PONT flexer at 70°C. Unaged samples measured after 6 hrs. — Aged samples after 2 hrs.

Buy Victory Bonds

DU PONT

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

INDIA RUBBER WORLD, February, 1946, Vol. 113, No. 5. Published monthly by BILL BROTHERS PUBLISHING CORP., 386 Fourth Avenue, New York 16, N. Y., U. S. A. Entered as second-class matter December 27, 1943, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Subscription, United States and Mexico, $3.00 per year; all other countries, $4.00; single copies, 35 cents.



Here's an example of HYCAR's pinpointed advertising to help you

THE advertisement shown here discusses an oil field application of HYCAR synthetic rubber. It appears only in petroleum publications—pinpointing that part of your market; going directly to people who will buy parts made from HYCAR.

It is typical of the specialized type of advertising that HYCAR is doing to reach all of your markets for HYCAR parts—automotive, aviation, engineering design, as well as a broad general audience.

It is our experience that this kind of advertising causes men throughout all industry to ask for parts made from HYCAR. It is our hope that it will encourage you and your sales staff to sell profitable *quality* parts instead of merely trying to meet low-price, low-profit competition.

These three helps will make it easier for you to sell parts made from a *superior* material:

. . . High quality special purpose synthetic rubbers.

. . . Technical aid in compounding problems.

. . . A strong national advertising campaign directed to *your* prospects.

Reprints of all HYCAR advertisements for use by your salesmen are yours for the asking. For reprints, more information about HYCAR, or for help with your problems, please write Dept. HC-2, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

Hycar

Reg. U. S. Pat. Off.

LARGEST PRIVATELY PRODUCED BUTADIENE TYPE

Synthetic Rubber

B. F. Goodrich Chemical Company

A DIVISION OF THE B. F. GOODRICH COMPANY



It's as easy as that...

with Philblack A!

EASY PROCESSING, that's what we mean! Faster, smoother tubing —lower loadings—no mold cooling (at 200°F, better tensile strength than EPC!) Yes, even just a little Philblack A added to your other blacks makes a demonstrable difference both in processing . . . and in the finished product.

For increased resilience, for better resistance to cuts, cracks and abrasion, more and more rubber manufacturers are using Philblack A. If you are not now using this better black, send in your trial order today!

PHILLIPS PETROLEUM COMPANY

Philblack *Division*

EVANS BANK BLDG. AKRON, OHIO

NAUGATUCK IS READY FOR YOUR RECONVERSION PROBLEMS!

Special Bulletins Have Been Prepared Covering Products Important To Your Post-War Plans

- No. 75 • Lead Press Garden Hose
- No. 76 • Freeze Resistant Tubing and Die Strips
- No. 77 • Steam Hose
- No. 78 • GR-S and GR-M Sponge
- No. 79 • GR-I Tire Curing Bags
- No. 82 • Sheet Packing
- No. 83 • Reclaim in GR-S Steam Hose
- No. 84 • Natural Rubber — GR-S Blends
  A Discussion of Physical Properties and Methods of Compounding Mixtures

Your Copy Is Available Upon Request

PROCESS — ACCELERATE — PROTECT
with

NAUGATUCK CHEMICAL
Division of United States Rubber Company
ROCKEFELLER CENTER, 1230 AVENUE OF THE AMERICAS, NEW YORK 20, N. Y.



Hydraulically Speaking.....

Robertson hydraulic equipment is designed and constructed with the backing of over 87 years' experience. In that time, we have built *only* hydraulic machinery . . . and the skill and "know-how" acquired through this specialized experience produces the fine quality for which Robertson Equipment has become world-renowned.

We are designers and builders of all types of lead encasing machinery for rubber hose and electrical cable manufacturers, including Extrusion Presses, Hydraulic Pumps, Melting Furnaces and Pots, Dies and Cores, Hydro-pneumatic Accumulators and Lead Sheath Stripping Machines.

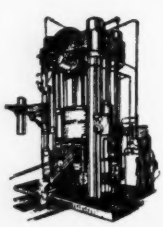
JOHN Robertson
COMPANY INCORPORATED

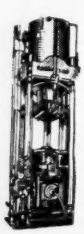
125-135 WATER STREET, BROOKLYN 1, NEW YORK

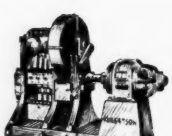
Designers and Builders of all Types of Lead Encasing Machinery

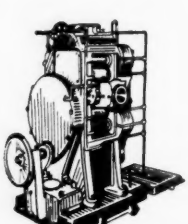
Since 1858

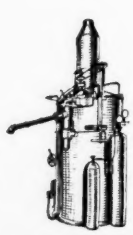

HYDRO-PNEUMATIC ACCUMULATOR


HOSE LEAD ENCASING PRESS


CABLE LEAD ENCASING PRESS


HIGH PRESSURE HYDRAULIC PUMP


LEAD SHEATH STRIPPING MACHINE

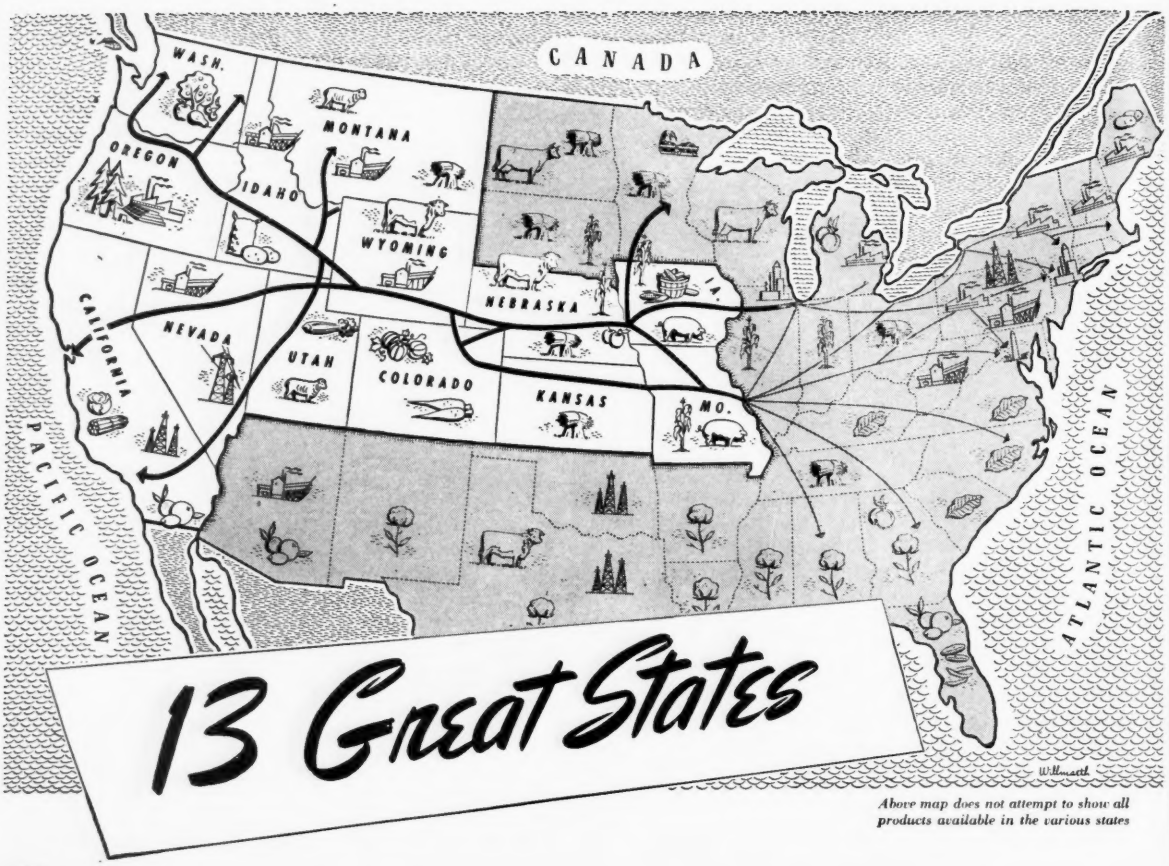

CLOSED LEAD MELTING POT



For technical data please write Dept. RA-2

B. F. Goodrich Chemical Company A DIVISION OF THE B. F. GOODRICH COMPANY

ROSE BUILDING, CLEVELAND 15, OHIO



Above map does not attempt to show all products available in the various states

For more than 75 years, Union Pacific has served thirteen western states . . . been a partner in their development.

This vast fertile territory is more than the breadbasket of the nation. Due to its great wealth of industrial raw materials—ore, minerals, petroleum and lumber—it might also be called the nation's treasure-chest. Rivers have been harnessed—providing irrigation and power. And there is splendid rail transportation.

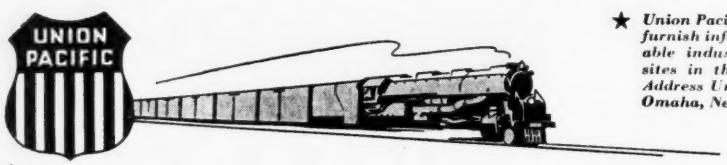
For example, in Nebraska, Kansas, California and practically all states in Union Pacific territory, the utilization of agricultural products by chemurgy has contributed greatly to the rubber industry. Union Pacific has the equipment and personnel to meet all the requirements of shippers in those regions.

These thirteen western states served by the railroad are ripe for postwar expansion. They have the materials, facilities and space.

Union Pacific will continue to play its part in the future progress of this western territory by providing unexcelled freight and passenger transportation over its Strategic Middle Route.

Be Specific— say "Union Pacific"

★ *Union Pacific will, upon request, furnish information about available industrial and mercantile sites in the territory it serves. Address Union Pacific Railroad, Omaha, Nebraska.*



The Progressive

UNION PACIFIC RAILROAD

The Strategic Middle Route

ANNOUNCING:

Bunac

REG. U. S. PAT. OFFICE

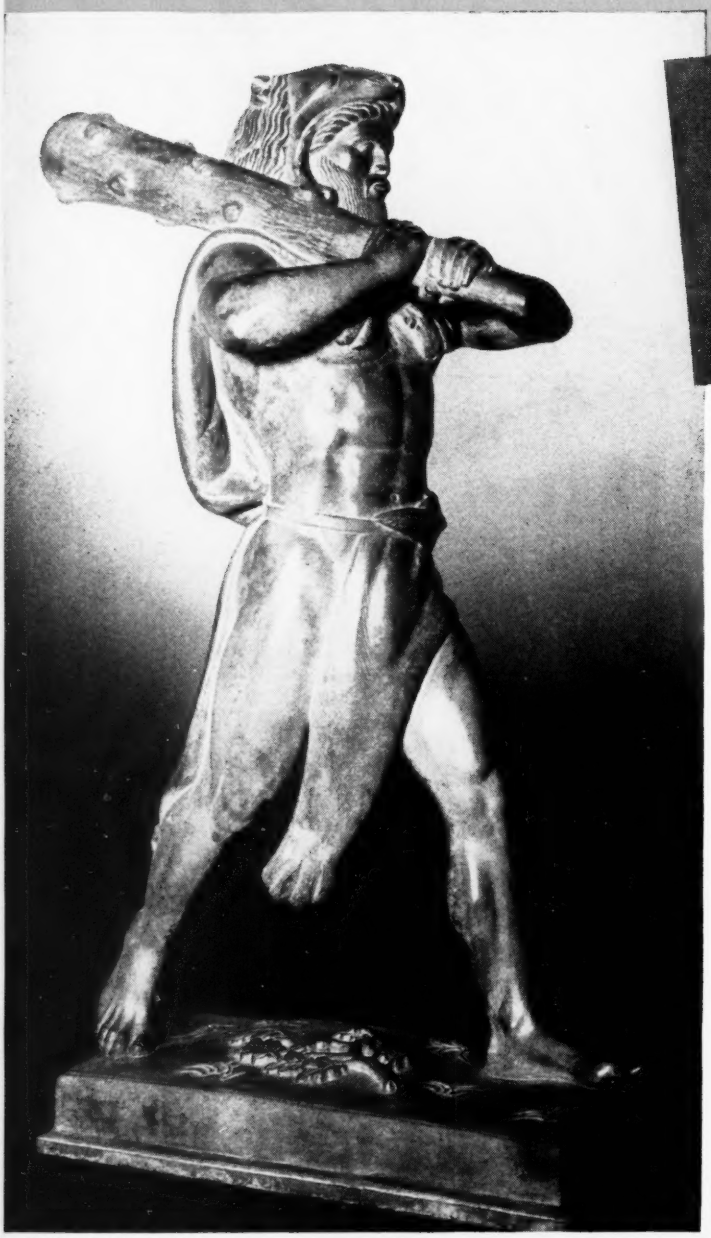
A NEW ACTIVATOR FOR GR-S

...BUNAC gives you Improved Cut-Growth Resistance— *without* Increased Heat Build-Up

W
-C=C-
REG U S PAT OFFICE

WILMINGTON
CHEMICAL CORPORATION
10 EAST 40TH STREET • NEW YORK 16, N. Y.

THIS SYMBOL



BRONZE BY PAUL MANSHIP

Hercules helps with broad range of materials

YOU are probably familiar with this symbol—where some individual Hercules product such as Solvenol*, Dipentene 122*, or Stay belite* Resin is concerned. But do you know about *all* the helpful materials it signifies? Would an acquaintance with them mean a better product for you—or an improvement or short-cut in your processing?

Ranging from chemical cotton for rayon tire cord to nitrocellulose for lacquer finishes, Hercules products have become of major importance in the manufacture of synthetic rubber, as well as in compounding, tire cord manufacture, reclaiming, and the formulation of rubber-base adhesives. They bring you the results of continuous research and development in almost every phase of application.

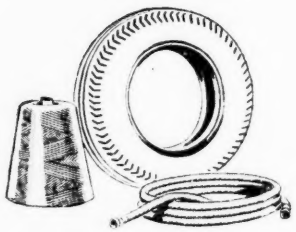
The significance, to you and your customers, of specific Hercules developments will form the basis of further advertisements. Watch for them. Meanwhile, the 48-page book, "Hercules Products," lists and describes the many materials now available. Write for your copy today.

HERCULES POWDER COMPANY
INCORPORATED
914 Market Street, Wilmington, Delaware

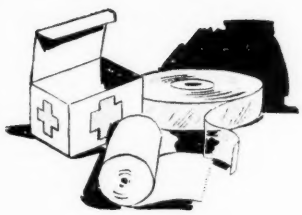
IT PAYS TO KNOW *MORE* ABOUT

HERCULES

YOUR GUIDE TO IMPROVED PROCESSES AND PRODUCTS



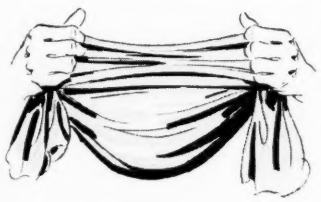
Chemical Cotton...
Basis for the toughest high-tenacity rayon for automobile tires, hose, belting, and other rubber products.



Staybelite Esters...
Low-cost tackifiers, compatible with all synthetic rubbers. Valuable in pressure-sensitive adhesives.



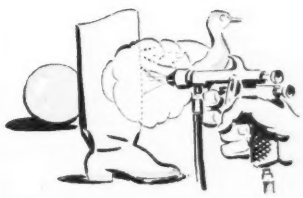
Dresinate 731...
One of Hercules many resin derivatives, Dresinate* 731 is the emulsifying agent used to make GR-S-10.



Dipentene 122...
An excellent solvent for rubber reclaiming. Raises tensile strength, lowers modulus, increases elongation.



Solvenol...
A stronger solvent than Dipentene, with a slower rate of evaporation. Widely used in rubber reclaiming.

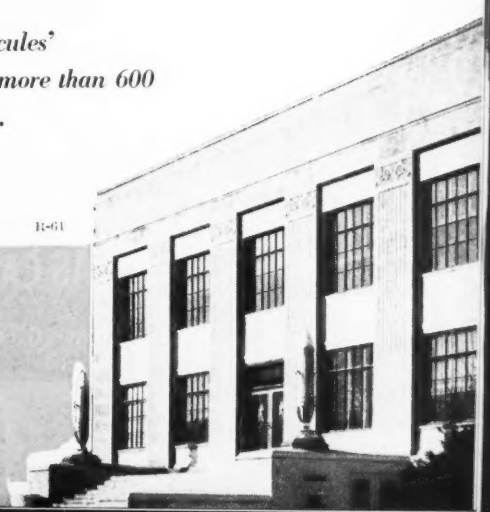


Nitrocellulose...
Hercules nitrocellulose and ethyl cellulose provide lacquers of maximum adhesion, durability, gloss, and color.

Back of every Hercules development for the rubber industry are Hercules' vast research facilities. In this laboratory, extending over 37 acres, more than 600 workers strive constantly to improve materials and finished products. Why not let them help you on your next problem?

*Reg. U. S. Pat. Off. by Hercules Powder Company

R-61



CHEMICAL MATERIALS FOR THE RUBBER INDUSTRY



Compounds with PELLETEX and GASTEX, the leading semi-reinforcing furnace blacks, are easy to process with both natural rubber and synthetics, and are particularly resistant to the destructive action of alkalies, acids and solvents. PELLETEX, the pellet form of GASTEX, is now available in any desired quantity.

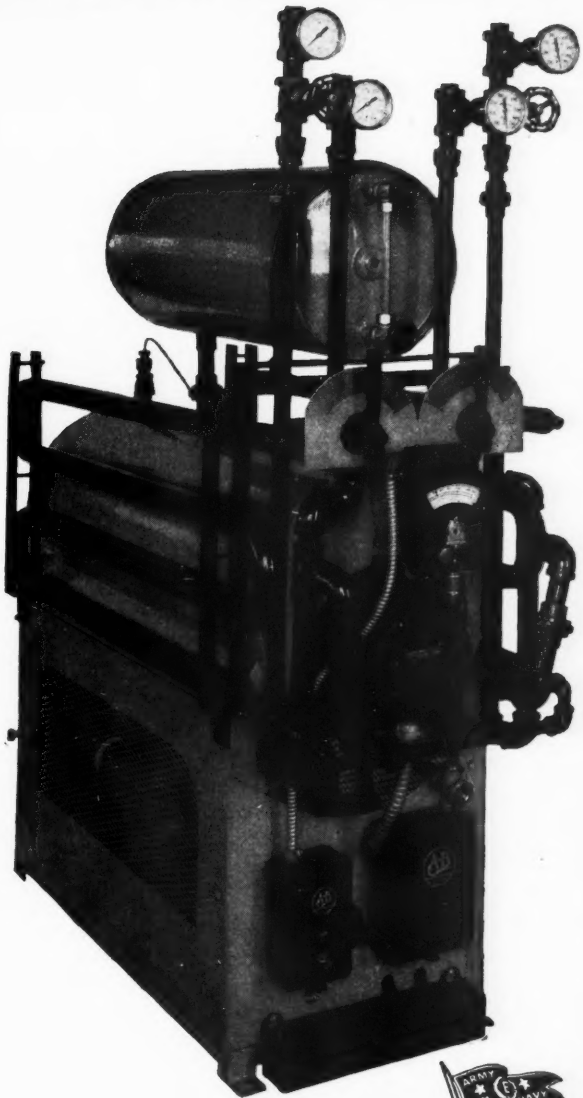
MANUFACTURER • DISTRIBUTOR

GENERAL ATLAS CARBON CO.
PELLETEX
GASTEX
PAMPA, TEXAS · GUYMON, OKLA.

HERRON BROS. and MEYER
NEW YORK, N.Y. AKRON, OHIO
RUBBER H AND M PIGMENTS Chemicals

Extruder Temperature Control Unit

- Wide temperature range available
- Sustains high or low extruding temperatures
- Supplies or removes heat from extruder as required
- Multiple circuits can be accommodated
- Hand lever selection of pre-determined extruding temperatures
- Available in two sizes
- Compact



ARMY E NAVY

JOHN ROYLE & SONS

ROYLE PATERSON N. J. 1880

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

James Day (Machinery) Ltd.
London, England
REgent 2430

Home Office
B. H. Davis J. W. VanRiper
SHerwood 2-8262

Akron, Ohio
J. C. Clinefelter
UNiversity 3726

PATERSON 3, NEW JERSEY

2 NEW, SAFE,* ECONOMICAL CATALYTIC AND POLYMERIZATION AGENTS

. . . decomposing at temperatures ranging from 70° C. to 250° C.

***These two interesting peroxides are not classified as explosive hazards by the Insurance Laboratories, Bureau of Explosives or I. C. C.**

*t-BUTYL PERBENZOATE

DESCRIPTION AND AVAILABILITY

A liquid, organic peroxide (8.00–8.50% available oxygen) which in addition to being relatively non-volatile and highly stable, is easily miscible with many Monomeric Materials, effectively catalysing these materials to form extremely clear, bubble-free films. *In limited commercial production. Samples will gladly be sent anyone interested.*

PROPERTIES

Molecular Weight	194
Available Oxygen	8.00-8.50%
Color	Light Yellow
Specific Gravity @ 20° C.	0.859
Refractive Index @ 25° C.	1.489
Vapor Pressure	Less than 10 mm. of mercury at 100° C.
Freezing Point	−2° to −4° C.
Decomposition Point	113°-116° C.
Sensitivity	Insensitive to shock, rubbing, grinding. Highly stable at room temperature.
Stability	Stable over iron, aluminum, copper, tin, zinc. Decomposes slowly over lead.
Solubility	Soluble in all proportions in all common organic solvents.

SUGGESTED USES

1. As an effective catalyst in bulk polymerizations.
2. As a good high temperature polymerization catalyst.
3. Wherever organic peroxides are of interest.

*t-BUTYL HYDROPEROXIDE

DESCRIPTION AND AVAILABILITY

An organic, alkyl peroxide that is standardized at a concentration of 60% (10.66% available oxygen). Use of proper activators increases the rate of release of oxygen. *In limited commercial production. Samples will be gladly sent anyone interested.*

PROPERTIES

Molecular Weight		90
Available Oxygen		10.66%
Color		Water White
Specific Gravity @ 25° C.		0.859
Refractive Index @ 25° C.		1.396
Boiling Range		90° - 107° C.
Flash Point		18.3° C.
Freezing Point		−35° C. to −36° C.
Decomposition Temperature		76.6° C.
pH of 1 part 60% Conc. in 10 parts water		4
Solubility	60% Conc. in water	11%
	Water in 60% Conc.	5%
	In short chain aliphatics	Excellent
	In aromatics	Excellent

SUGGESTED USES

1. As a catalytic agent in single and two phase polymerization reactions, as for example: in the polymerization of vinyl polymers and co-polymers; in the polymerization of diene hydrocarbons used in synthetic elastomers.
2. As a source of oxygen in the drying of paints.
3. As an oxidizing agent for laboratory purposes.

*U. S. Patents 2176407, 2223807, 2298405

Address all inquiries to the Union Bay State Chemical Company, Peroxides Division, 50 Harvard Street, Cambridge 42, Massachusetts.

UBS

UNION BAY STATE *Chemical Company*

Serving Industry with Creative Chemistry

ORGANIC CHEMICALS · SYNTHETIC LATEX · SYNTHETIC RUBBER
PLASTICS · INDUSTRIAL ADHESIVES · DISPERSIONS
COATING COMPOUNDS · IMPREGNATING MATERIALS · COMBINING CEMENTS

projecting the reasons why rayon cord tires are superior...

RAYON CORD TIRES ARE *SAFER, WEAR LONGER*



BECAUSE THEY *RUN COOLER!*

The lighter the tire, the cooler the running. Tire men will tell you that. Rayon cord, because it's stronger, requires less cord and less rubber; therefore makes a lighter tire.

What's more, as a tire heats up, rayon's strength goes up. And there you have it—rayon defies heat, gives a cooler running tire whether made with natural rubber, synthetic rubber or combinations of the two.

These two heat-resisting factors are responsible for the reports of bus and truck fleet operators who have used rayon cord tires and found them longer on mileage, shorter on blow-outs and road failure.

Perhaps it's hard to believe that rayon, dainty filament of fashion, should prove the ideal fiber [illegible] tires. But the war proved it, and our mobile armies kept rolling on rayon. Now you, the motorists of America, will profit by the lessons learned on the treacherous highways of war.

You'll soon be riding on rayon yourself. You'll be experiencing a new concept of tire performance—tires that will wear as long as you will want to drive your car—tires that will carry you more comfortably because they flex easier and offer less rolling resistance—tires that run cooler, reducing the menace of blow-outs and road failure. It will be a new day in motoring—the day you drive off on your first rayon cord tires.

Industrial Rayon has been manufacturing rayon tire yarn, cord and fabric right through the war. And now our rayon, known as Tyron, is rolling out in a steady stream for the tires of peace. Made by our exclusive Continuous Process, Tyron is given the utmost uniformity—and it's the uniformity of the cord and fabric that makes for uniformity in the tire, so essential in tire manufacturing and tire performance.

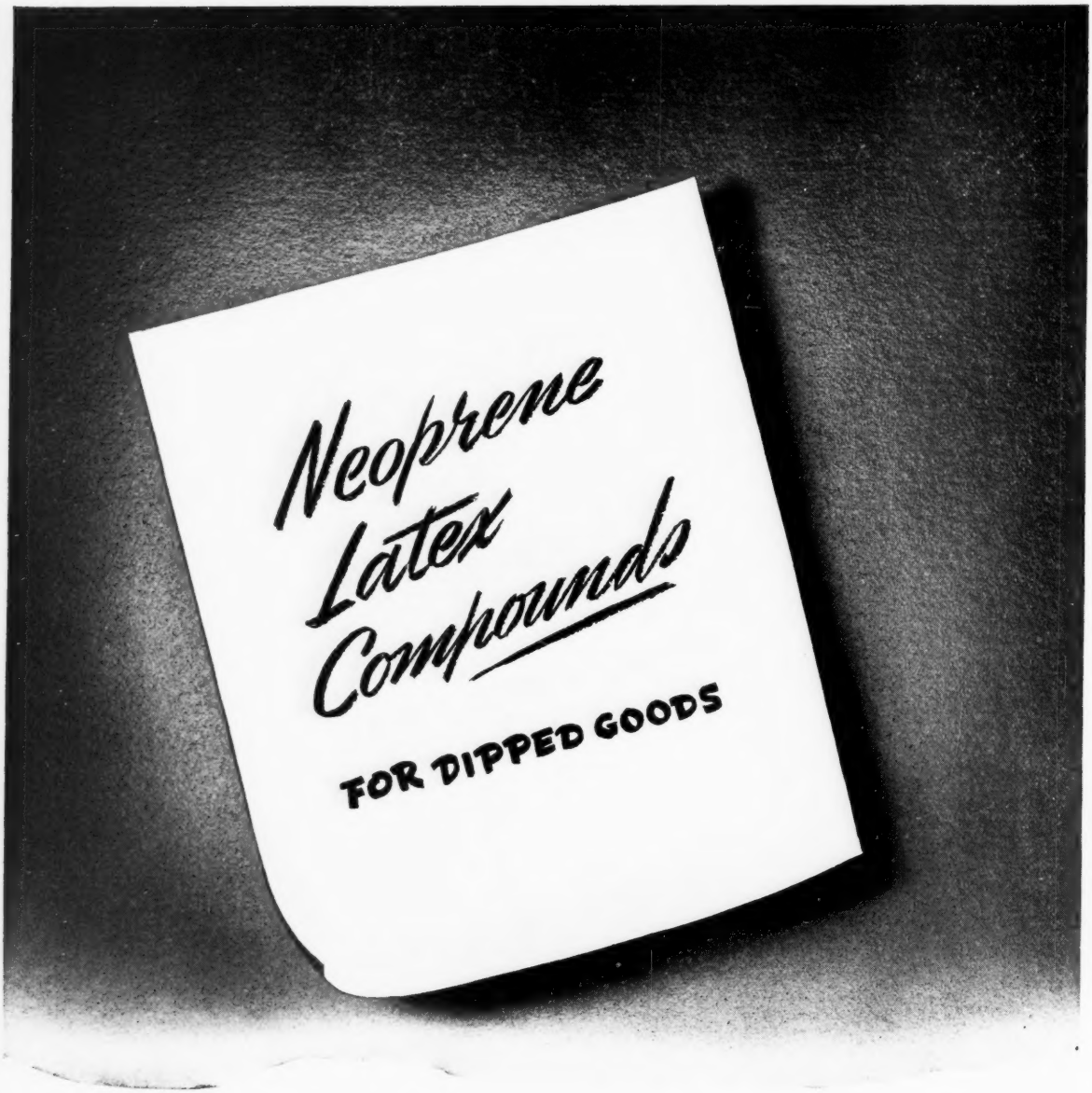
Industrial
RAYON CORPORATION
Cleveland, Ohio
makers of TYRON and rayon

...to 14,463,906 more American motorists

This ad, appearing in THE SATURDAY EVENING POST, COLLIER'S and THE AMERICAN WEEKLY, is another in Industrial's series, acquainting the American public with the enormous advances in tire-making made possible by the use of the miracle fibre, Rayon. An ad can only tell so much. For you, in the trade, we have a much more complete story in booklet form. Send for "Rolling on Rayon." It's FREE and "must" reading for every one connected with the tire industry.

*TYRON rayon for tires
Made by INDUSTRIAL RAYON CORPORATION
Cleveland, Ohio

*Reg U S Pat Off



General Latex has developed several simplified neoprene latex compounds for dipped goods. These compounds are thoroughly "tried and proven" and in current use in many factories. Neoprene latex offers advantages not found in natural rubber latex—more particularly, high resistance to oxidation, sunlight, oils, and chemicals. If you are considering the manufacture of any dipped product, we suggest that you get in touch with our technical staff. Their years of experience with natural and neoprene latex will prove very helpful in formulating a neoprene compound custom-made to your specific needs.

General Latex
& CHEMICAL CORP.
666 MAIN STREET, CAMBRIDGE, MASS.

Vultex Division — Verdun Industrial Buildings, Verdun, Montreal, Quebec

Agents for Rubber Reserve Company for storage and distribution of natural rubber latex. Distributors for Rubber Reserve Company for synthetic latex. Operators of the Government owned Baytown, Texas, synthetic rubber plant in collaboration with the General Tire & Rubber Co.

Serving the

Rubber Processing

industry for over 30 years!

For Washers · Crackers ·

Refiners · Mills · Calenders ·

All Types · All Sizes ·



In the hardest, most exacting rolling applications in the rubber processing industry, you will find UNITED ROLLS serving better, more efficiently, more economically. Their consistently superior performance is the result of many years experience in roll design and manufacture, sound engineering and unsurpassed production facilities. Unsparing research, and constant study of the industry's requirements, have made and kept them favorites with rubber manufacturers in all parts of the world.

UE&FCO REG. T.M.

UNITED ENGINEERING AND FOUNDRY COMPANY
Pittsburgh, Pennsylvania

Plants at Pittsburgh · Vandergrift · New Castle · Youngstown · Canton

Subsidiary: Adamson United Company, Akron, Ohio

Affiliates: Davy and United Engineering Company, Ltd., Sheffield, England
Dominion Engineering Works, Ltd., Montreal, P. Q., Canada

★ *The World's Largest Designers and Makers of Rolls and Rolling Mill Equipment*

TITANOX... *the brightest name in titanium pigments*

BARRELS TO BOXCARS



In 1914, four barrels of Titanox-B were made and shipped from a pilot plant in Niagara Falls, New York. This was the first production run of titanium barium pigment in the United States . . . and represents another "TITANIUM PIGMENT FIRST"

Today, Titanox pigments are shipped in carload quantities. The experimental plant at Niagara Falls has given way to huge factories, one at St. Louis and the other at Sayreville, N. J.

The reason for this tremendous growth is understandable when you consider the exceptional qualities that Titanox pigments impart to various products: high opacity, whiteness and brightness. These, combined with chemical inertness and extremely fine particle size, make Titanox pigments the most efficient obtainable. Always economical, they have steadily decreased in cost through the years.

Constant progress in improving industry's products with Titanox pigments has always been – and is now – a major endeavor of their producers. While maintaining quality standards, every effort is being made to produce greater quantities of Titanox pigments to meet growing needs in many fields.

TITANOX TITANIUM PIGMENT CORPORATION
SOLE SALES AGENT

111 Broadway, New York 6, N. Y.
104 South Michigan Ave., Chicago 3, Ill.
350 Townsend St., San Francisco 7, Cal.
2472 Enterprise St., Los Angeles 21, Cal.

ORLD

RS



various
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prod-
— and
While
being
x pig-

Use UNITED BLACKS for best results

KOSMOS 20 DIXIE 20	SRF
KOSMOS 40 DIXIE 40	HMF
KOSMOBILE 77 DIXIEDENSED 77	EPC



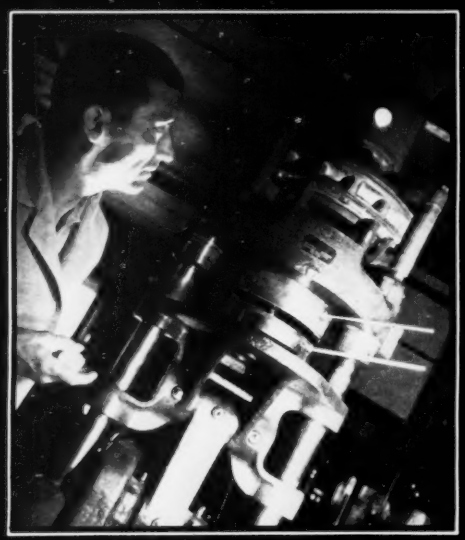
UNITED CARBON COMPANY, INC.

CHARLESTON, W. VA.

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At Your Service—

RESEARCH



STUDYING THE PROCESSING CHARACTERISTICS OF RUBBER WITH AN EXTRUSION PLASTOMETER

United research facilities and extensive laboratories, fully staffed with trained personnel, have these standing assignments:

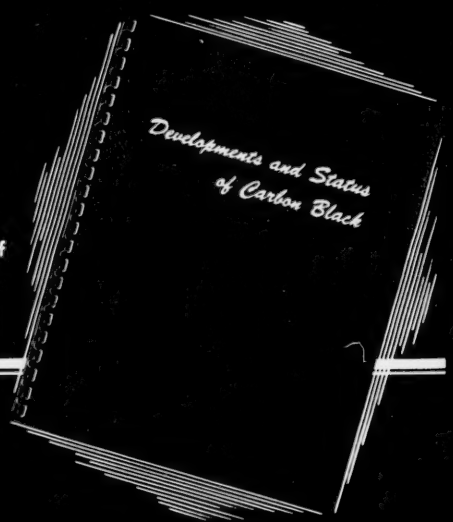
1. To control the carbon black production to specifications and uniformity.

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3. To anticipate the needs and demands of industry for improved types of carbon black.

Let United's research organization work with you on your carbon black problems. Prompt service and the utmost cooperation rendered. Your inquiries will receive immediate attention.

Would you like to have a copy of "Developments and Status of Carbon Black?" It will be sent to you on request.



RESEARCH DIVISION

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Charleston, West Virginia



BAKER PLASTICIZERS

IMPART

Retained Flexibility

TO

VINYL RESINS CELLULOSE RESINS

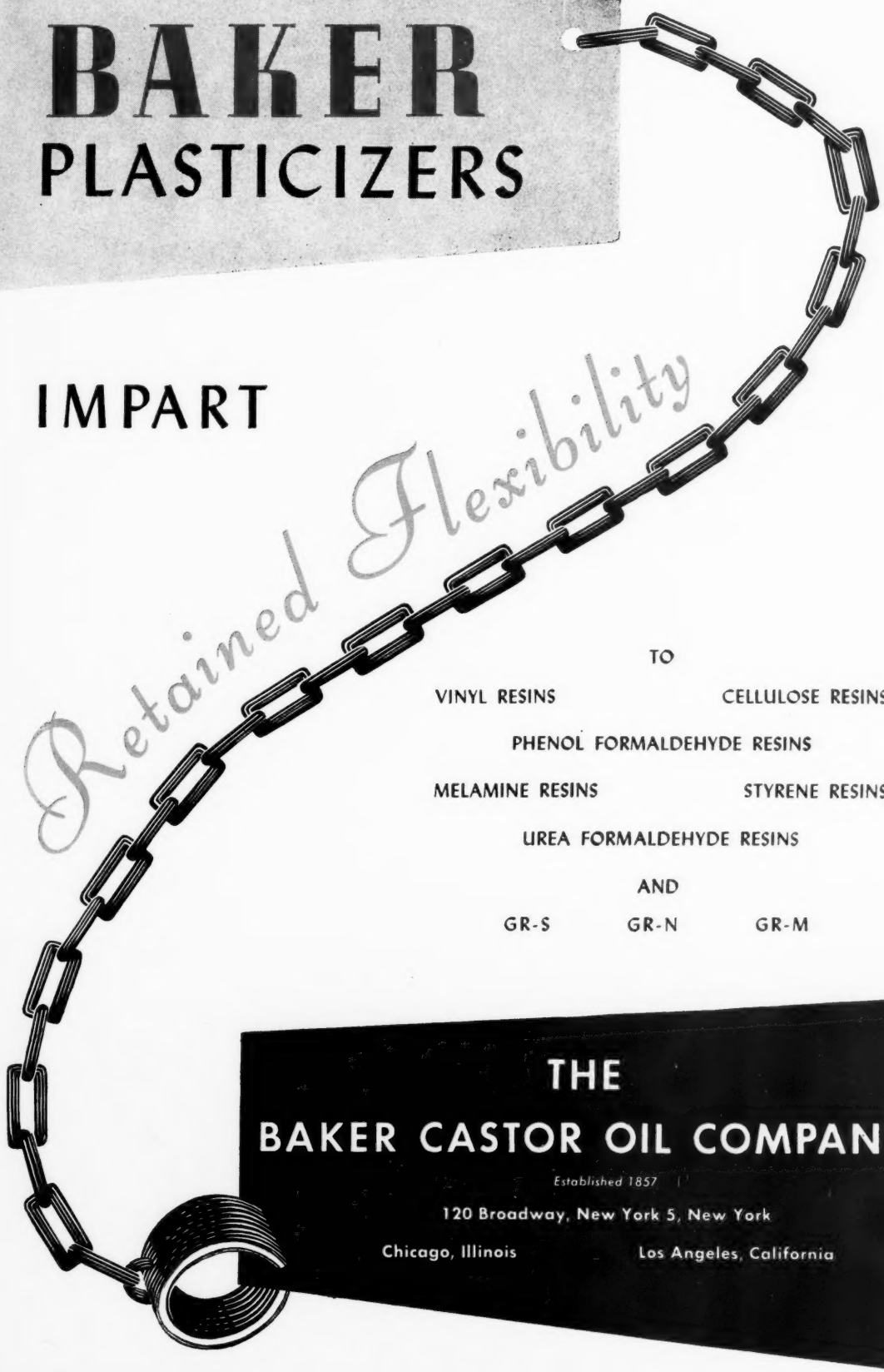
PHENOL FORMALDEHYDE RESINS

MELAMINE RESINS STYRENE RESINS

UREA FORMALDEHYDE RESINS

AND

GR-S GR-N GR-M



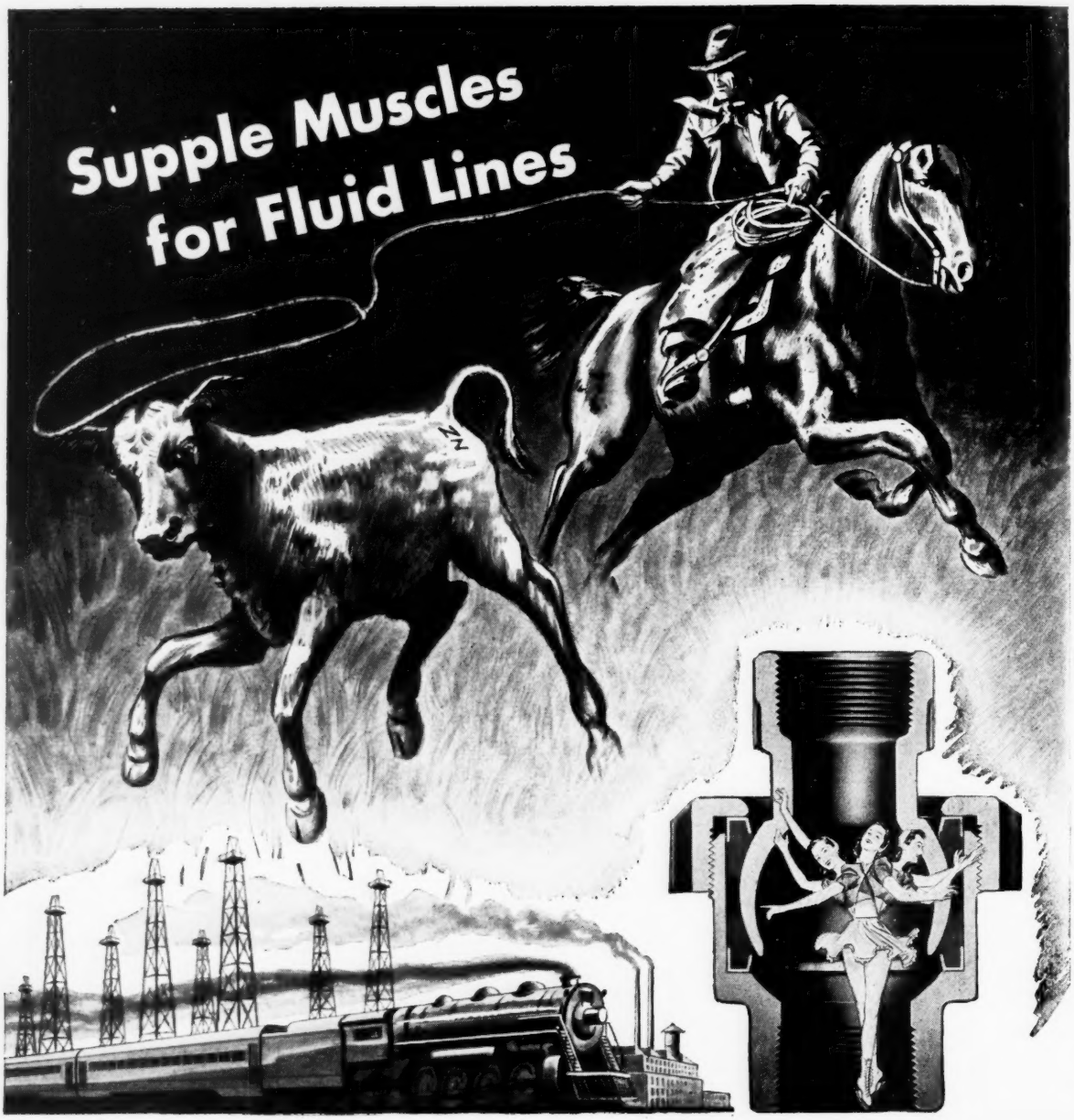
THE

BAKER CASTOR OIL COMPANY

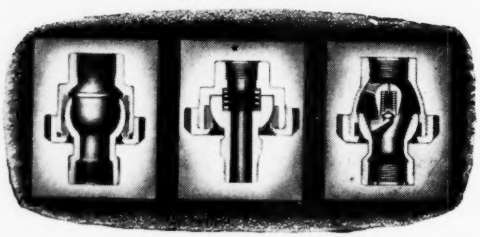
Established 1857

120 Broadway, New York 5, New York

Chicago, Illinois Los Angeles, California



Fluid-conveying pipes must be both strong and flexible to withstand the strains of changing pressures and constant vibration. Barco Flexible Joints assure compensating movement in every direction . . . responding instantly and automatically. In the complete line of Barco Joints you will find just the type and size to meet your needs. Complete information furnished promptly. Write Barco Manufacturing Company, Not Inc., 1810 Winnemac Avenue, Chicago 40, Illinois.



BARCO **FLEXIBLE JOINTS**

Not just a swivel joint . . . but a combination of a swivel and ball joint with rotary motion and responsive movement through every angle.

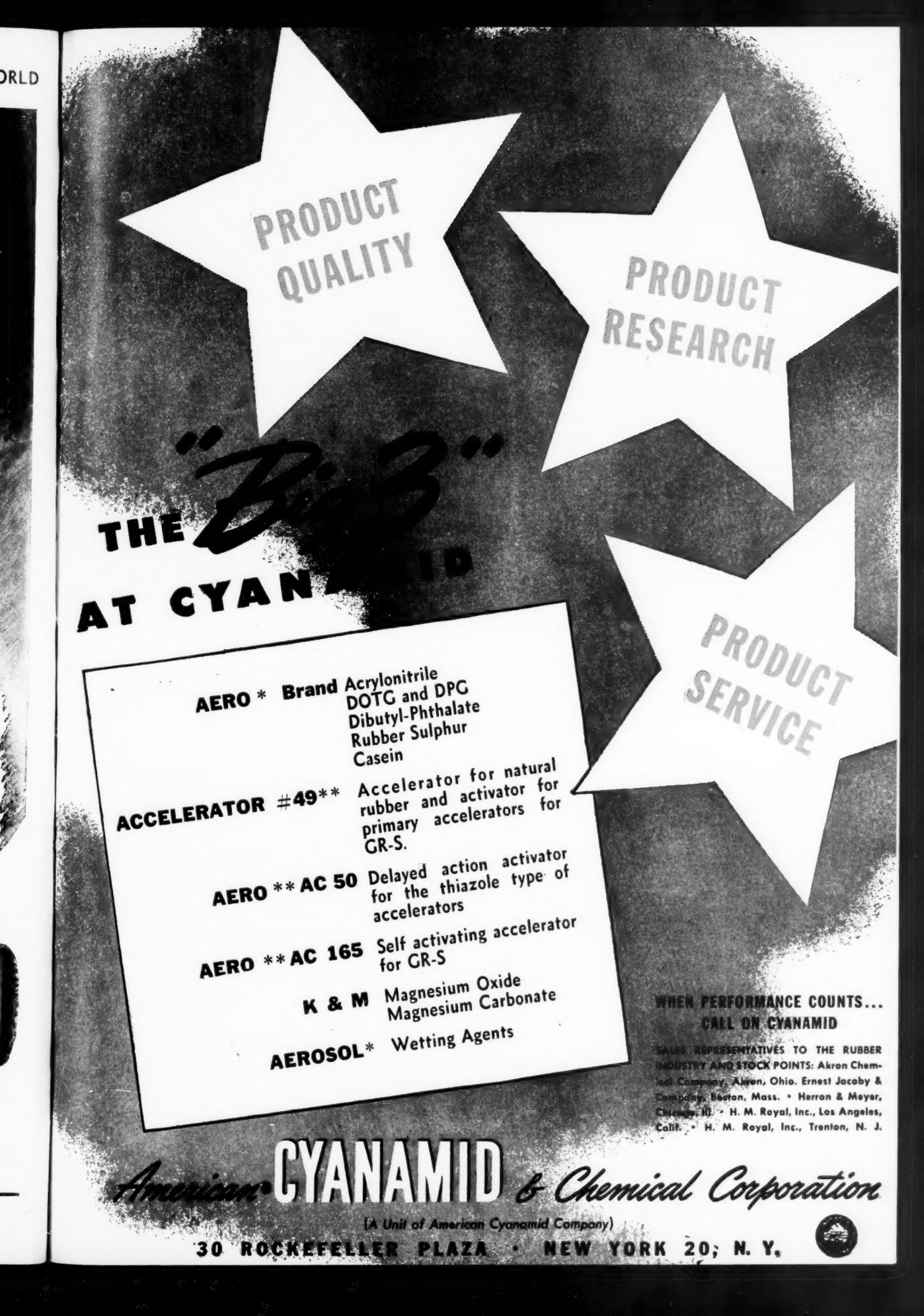
FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY

In Canada: The Holden Co., Ltd., Montreal, Canada



"MOVE IN EVERY DIRECTION"

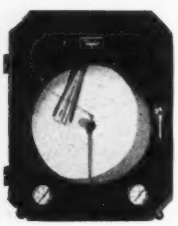



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ACCELERATOR #49** Accelerator for natural rubber and activator for primary accelerators for GR-S.
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K & M Magnesium Oxide
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WHEN PERFORMANCE COUNTS...
CALL ON CYANAMID
SALES REPRESENTATIVES TO THE RUBBER INDUSTRY AND STOCK POINTS: Akron Chemical Company, Akron, Ohio. Ernest Jacoby & Company, Boston, Mass. • Herron & Meyer, Chicago, Ill. • H. M. Royal, Inc., Los Angeles, Calif. • H. M. Royal, Inc., Trenton, N. J.
American CYANAMID & Chemical Corporation
(A Unit of American Cyanamid Company)
30 ROCKEFELLER PLAZA • NEW YORK 20, N. Y.

Use of butyl synthetic rubber for the manufacturer of all passenger inner tubes in 6.00-16 sizes and smaller will be permitted after January 1. Tubes for small trucks and small tractor-implement tires may be made of butyl. The greater air-retaining qualities of butyl permit more uniform tire pressure.

COURTESY OF THE B. F. GOODRICH CO.
—"THE RUBBER NEWS LETTER"

How's your Butyl tube production?



IF you've been fretting and stewing over your butyl tube production for the civilian market, listen to this! Taylor Instrument has a revolutionary but simple plan for giving you closer, more accurate control over your tube curing than was ever thought possible before.

Briefly, the idea is this: Instead of having just one temperature controller on the header to a battery of presses, put an individual Taylor Fulscope Recording Temperature Controller on each press.

This way, you get the necessary flexibility to meet different tube specifications in the same battery. Get into production immediately with the least possible error by maintaining really accurate individual temperature control. In a word, you will be doing everything possible to "make butyl rubber act natural!"

We engineered the first setup like this for a leading rubber company and we're anxious to help you get started right too. Call your Taylor Field Engineer. Or write today! Taylor Instrument Companies, Rochester 1, N. Y., or Toronto, Canada. *Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.*

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY

"Pin-Up" for '46



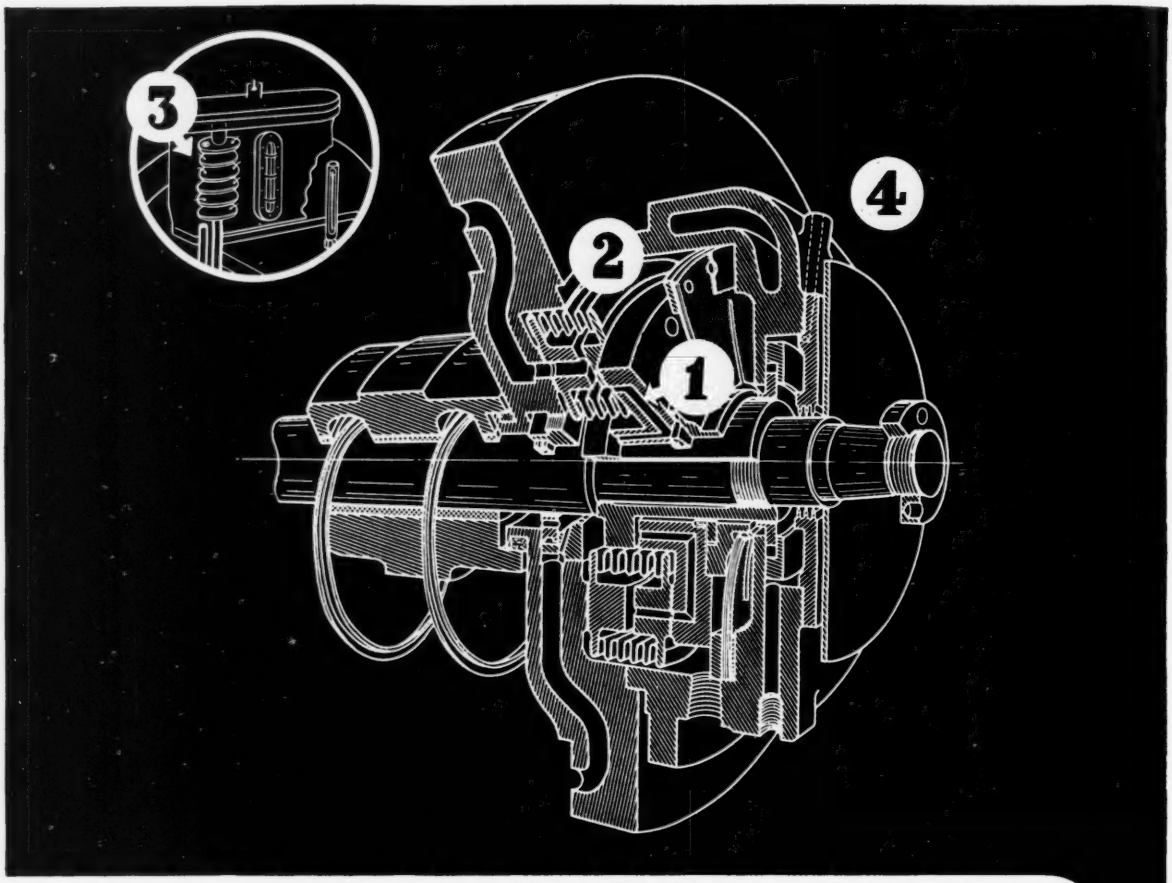
HERE'S an appealing vision for millions of motorists. . . White side-wall tires with red tubes—hmm-m, a gorgeous set-up for any man's money! The real thing can soon replace the vision. Red tubes of Butyl rubber are here now, thanks to SILENE EF. . . Next is the white side-wall tire. . . And that, too, is a probable "come-back" in 1946. It also will be made possible by SILENE EF. . . This fine white reinforcing pigment is assuring greater success in color compounding. It is essential in many non-black compounds to give them needed processing qualities, and the good cured physical properties unobtainable when clays or whitings are used alone as the loading pigment.

SILENE EF

STANDARD *Chemical Company*

General Offices: AKRON 8, OHIO

New England: 335 Chamber of Commerce Bldg., Boston, Mass.
Mid-Atlantic: Broad Street Bank Bldg., Trenton, N. J.
Mid-West: 2724 W. Lawrence Ave., Chicago, Ill.



The Centrifugal with the Dollar-saving Seal

The centrifugal refrigerating machine pioneered by Carrier has the money-saving advantages of a positive, simple, fully automatic seal *without surface contact* while in operation. This seal—of revolutionary Carrier design—saves thousands of dollars in refrigerant losses . . . reduces corrosion and power loss by keeping out moisture and air.

The passage of refrigerant and air along the high-speed shaft is prevented by a pressure oil film. This oil holds the seal faces apart when the compressor is operating, making metal-to-metal contact impossible. By the elimination of surface wear the seal is assured long life and perfect adjustment. Maintenance costs are kept at a minimum.

The dollar-saving Carrier seal—like the centrifugal itself—is the product of the most experienced engineering staff in the whole field of air conditioning and refrigeration. You can count on Carrier centrifugal refrigeration units. They're designed and built to deliver years of uninterrupted service. That's been proved by 25 years' successful operation. Carrier Corporation, Syracuse, N. Y.

Carrier

AIR CONDITIONING
REFRIGERATION
INDUSTRIAL HEATING

① Oil under pressure forces seal faces apart when compressor is operating. This forms an effective seal against loss of refrigerant and admission of air and water, prevents wear due to metal-to-metal contact. Thin oil film is maintained between stationary and rotating seal face during shutdown periods.

② Fatigue of metal bellows is overcome by design of seal. Bellows move to a fixed position when compressor is starting or stopping and are not subject to the movements of shaft and rotating seal faces.

③ Seal is supplied continuously with clean oil. Both strainer and cloth filter remove all impurities, extending seal life.

④ Inspection of seal is fast and simple. Access to it is by removing six nuts.

Specify SHARPLES VULTAC

to improve HEAT-RESISTANCE of your products

Sharples VULTACS — offered in three modifications varying in sulfur content — provide a new approach to the problem of building heat-resistance into both GR-S and GR-A formulations.

VULTAC No. 2 and VULTAC No. 3 may be used advantageously as total replacements for sulfur to give GR-S and GR-A stocks capable of withstanding temperatures of up to 250° F. over extended periods. This effect is particularly pronounced when they are used in conjunction with thiuram type vulcanizing agents in compounding GR-S. As supporting evidence, data in the table illustrate that VULTAC No. 2, when used in combination with Ethyl Tuads, results in a GR-S stock combining outstanding heat resistance with the following superior qualities:

1. **Maintenance of tensile strength and elongation upon extended cure.**
2. **Retention of tensile strength and elongation after severe aging.**
3. **Lower "Marching Modulus" upon aging.**

Other advantages realized through the use of these new primary vulcanizing agents are:

BETTER PROCESSING CHARACTERISTICS — The VULTACS soften at milling and Banbury mixing temperatures — a property which combined with their solubility characteristics permits incorporation very readily in the rubber mix. When added during early stages of mixing they serve as processing aids and at the same time improve the dispersion of fillers and pigments.

IMPROVED TACK — VULTAC No. 1 as a monosulfide is a milder vulcanizing agent than the disulfides. VULTAC No. 2 or VULTAC No. 3, and can be tolerated in larger proportion without producing over-cure. Its use is therefore recommended for those applications requiring larger amounts to obtain maximum tack and at the same time good heat resistance will be imparted to the stock. When VULTAC No. 1 is used, it is necessary to add a certain amount of pigment sulfur to the mix.

FORMULA

GR-S	100
EPC Carbon Black	50
Zinc Oxide	3
Coal Tar Softener	5
Resin Turpentine	5
Coumarone-Indene Resin (Medium Hard)	3

Ethyl Tuads ..... 1.75 parts VULTAC No. 2..... 4.0 parts				Minutes Cure at 290° F.	Ethyl Tuads ..... 0.5 parts Sulfur ..... 2.0 parts			
Modulus 300%	Tensile p.s.i.	Elongation %	Shore Hardness		Modulus 300%	Tensile p.s.i.	Elongation %	Shore Hardness
ORIGINAL PROPERTIES								
380	1890	850	54	10	90	280	880	50
430	2110	810	60	15	350	1670	820	59
510	2310	770	60	30	780	2890	700	61
520	2440	750	60	45	920	2910	650	65
600	2590	750	64	60	980	2500	550	65
AFTER AGING 72 HRS. AT 212° F. IN AIR OVEN								
1360	3040	570	70	10	1150	2200	520	70
1340	3180	610	71	15	1570	2850	530	74
1170	3090	660	71	30	1750	2890	480	75
1070	2970	680	71	45	1870	2700	420	75
1020	3150	670	71	60	1750	2370	400	75
AFTER AGING 144 HRS. AT 212° F. IN AIR OVEN								
1330	3050	580	71	10	1420	2050	420	70
1320	3050	590	71	15	1990	2500	380	76
1190	2890	640	71	30	2280	2530	340	78
1180	2900	640	73	45	—	2200	280	80
1180	2700	610	73	60	—	1930	240	80

Additional information is presented in Sharples Booklet 44-1 entitled VULTAC. A copy of the booklet together with samples will be sent at your request.

SHARPLES TRADE MARK CHEMICALS

SHARPLES CHEMICALS INC.

PHILADELPHIA CHICAGO NEW YORK

ARMY E NAVY

TELLING THE PUBLIC

TIRES made with RAYON CORD keep them Safer!



LIKE SHATTER-PROOF GLASS

LIKE ALL-STEEL TOPS

tires made with rayon cord stand out today as a great milestone in motoring safety. They'll soon be rolling beneath America's cars in greater and greater numbers.

Proved safer by Army tests, rayon cord tires were demanded by the Army early in the war . . . demanded for bombers, trucks, jeeps, mobile guns, fighter planes.

Many million rayon cord military tires have since proved the Army right. So have countless million miles of war-necessary service of bus and truck companies.

Now, tire makers are preparing to put *all* America on rayon cord tires because they're *safer, more economical on gasoline, longer lasting* and *smoother riding.*

Research engineers at American Viscose Corporation, working with the Government and tire manufacturers, helped develop these special rayon tire cords.

We are proud of our part in raising another great milestone on the road to greater motoring safety.

Why the Army Used Rayon Cord Tires

Rayon cord makes tires stronger, safer, lighter. Rayon is made in continuous filaments, of uniform diameter and strength. Higher tensile strength permits thinner sidewalls, reducing rubber-harming friction heat. Rayon retains more tensile strength at high running temperatures and withstands almost infinite flexing. (Source: Hearings before a Special Committee Investigating the National Defense Program. United States Senate—Seventy-Eighth Congress, First and Second Sessions.)

More Safety—Less Operating Cost

Bus and truck companies report that less friction heat, higher tensile strength, and greater uniformity of rayon tire cords mean more safety at high running speeds. Rayon cord tires give longer life, greater mileage . . . reduce impact failures, blowouts, road delays, tire renewals.

AMERICAN VISCOSE CORPORATION

America's largest producer of rayon tire cord, yarn and staple fiber

Offices: 350 Fifth Avenue, New York 1, N. Y.; Charlotte, N. C.; Philadelphia, Pa.; Providence, R. I.; Washington, D. C.; Wilmington, Del.

THIS ADVERTISEMENT appears in THE SATURDAY EVENING POST and a representative list of other important national magazines.

about Rayon Cord Tires

To help acquaint the public with the advantages of rayon cord in tires, American Viscose Corporation has embarked on a campaign to point out that the same qualities which made rayon cord military tires tougher and commercial tires more serviceable . . . will now make civilian tires *safer* and *more economical.*

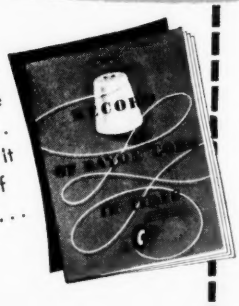
Our research engineers took active part in the development work that led to the Army's choice of rayon for military tires. Our current goal is to continue cooperative development in every possible way so that stronger, safer, more economical rayon cord tires will be available to motorists everywhere at the earliest possible moment.

AMERICAN VISCOSE CORPORATION

America's largest producer of rayon

Offices: 350 Fifth Avenue, New York 1, N. Y.; Charlotte, N. C.; Philadelphia, Pa.; Providence, R. I.; Washington, D. C.; Wilmington, Del.

Here's a handy coupon to make it easier for you to get the free booklet . . . to be offered through our national advertising . . . that your customers are sending for. It tells the impressive story of "The Record of Rayon Cord in Tires." Just fill in and mail . . .



AMERICAN VISCOSE CORPORATION Dept. IR-2
350 Fifth Avenue, New York 1, N. Y.

Gentlemen:
Please forward without obligation or cost to me a copy of "The Record of Rayon Cord in Tires."

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Biggs

VULCANIZERS and DEVULCANIZERS Have Served the Rubber Industry for More Than 45 Years



Fig. 1—15-ft. diameter by 45-ft. long horizontal vulcanizer with quick-opening door for vulcanizing rubber linings in large storage tanks. *Fig. 2*—Biggs vulcanizer with special heating manifolds and circulating fan; all sizes, various working pressures.

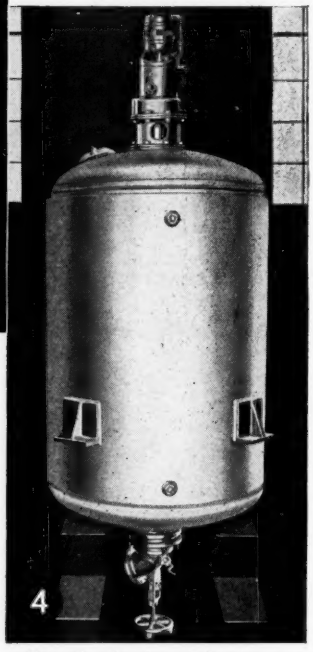
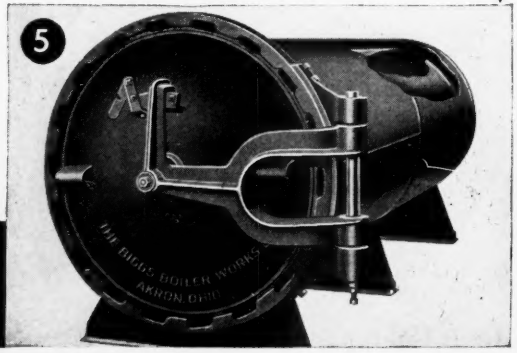


Fig. 3—vertical vulcanizer with quick-opening door. Door is handled by self-contained arm and gear-operating mechanism. Hand or motor operation.

Fig. 4—high pressure heavy duty jacketed vertical devulcanizer with special agitator. Furnished in various sizes.

Fig. 5—horizontal steam-jacketed vulcanizer with hinge type quick-opening door; all sizes, for various working pressures. Welded construction throughout.

BIGGS-built vulcanizers and devulcanizers have occupied a prominent place in the development of the rubber industry since its inception. For more than 45 years Biggs has furnished single-shell and jacketed vulcanizers both vertical and horizontal, as well as many different types of devulcanizers to meet various requirements of the reclaim experts. . . . It is a far cry from the old days of bolted doors and riveted construction to Biggs modern all-welded units with quick-opening doors. Biggs vulcanizers and devulcanizers are available in all sizes and for various working pressures — with numerous special features. *Write now for our Bulletin 45.*



BIGGS-WELD

THE *Biggs* BOILER WORKS CO.

1007 BANK STREET, AKRON 5, OHIO, U.S.A.

Essential!

GLYCERIZED

(LIQUID CONCENTRATE)

LUBRICANT

Yes GLYCERIZED *has proved to be an essential agent in modern day rubber processing!* . . . . . .

GLYCERIZED eliminates unhealthful and annoying 'dust' arising from the use of soapstone, talc, etc. Merely by dipping the slabs as they are cut from the mixing mill into a GLYCERIZED solution, all stickiness is done away with. Complete separation of piled stocks is assured. Adhesion is abolished! The cost is but a fraction of the former, old dusty method.

GLYCERIZED solution prevents sticking during cure of extrusions and tubing, when coiled on the flat pan or continuous running. Lubrication of molds, mandrels, air bags, belt drums, insulated wire and cable, etc. are all vastly facilitated by applications of GLYCERIZED solution.

Inner tubes, automotive parts and other molded and extruded goods are washed and finished readily with GLYCERIZED solution. It cleans thoroughly and lends that glossy, satiny finish so desirable in rubber products. Specific directions and proportions are furnished with each shipment.

GLYCERIZED is truly a versatile lubricant adapted to all types of synthetic rubbers as well as to natural rubber, reclaim or mixture thereof. During war and peace, GLYCERIZED LUBRICANT has served faithfully throughout the entire rubber industry. Many rubber concerns who won the Award for Excellence in War Production received consistent support in supplies of GLYCERIZED LUBRICANT which were at all times unfaltering.

GET THE GENUINE *from* GENSEKE

Yes GLYCERIZED *has well earned its place as the established lubricant in rubber processing* . . .

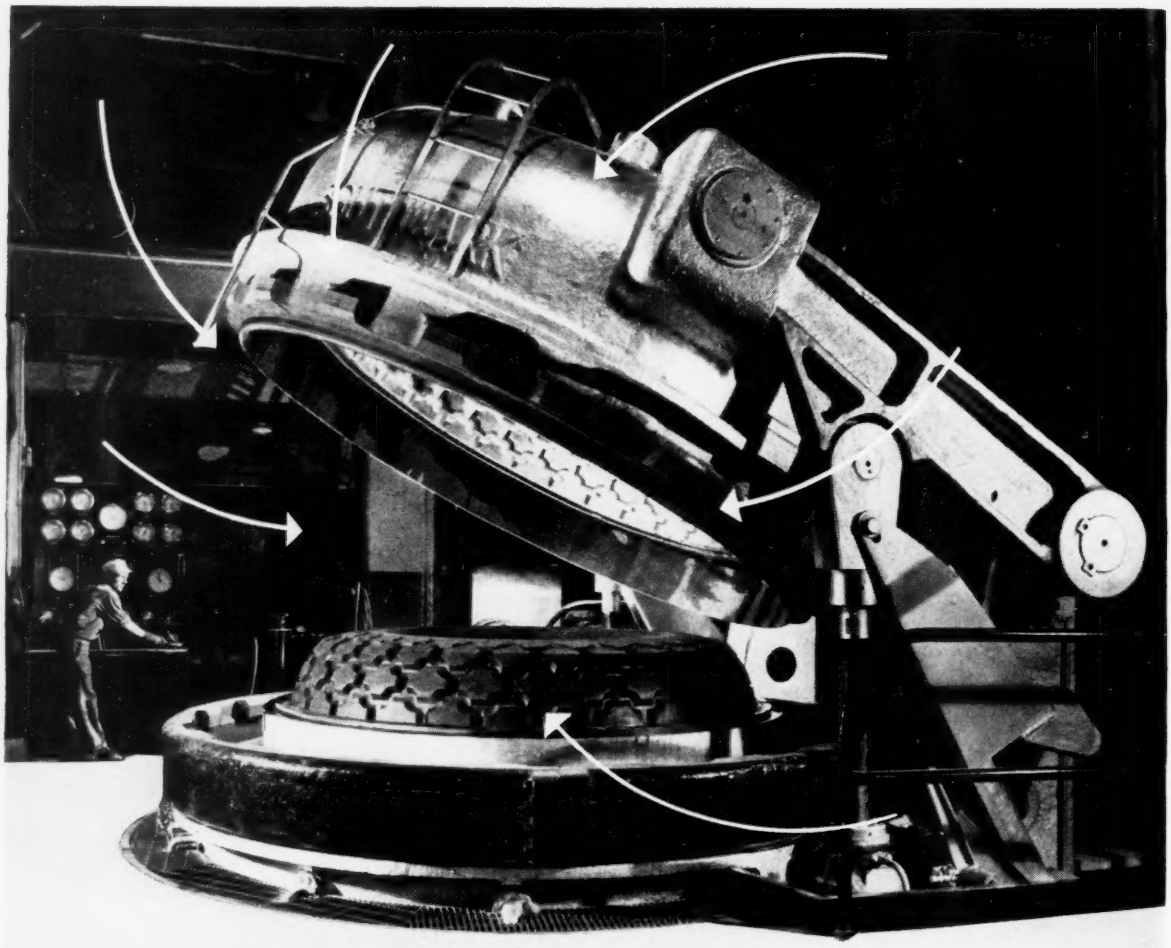
AVAILABLE IN DRUMS, HALF DRUMS AND QUARTER DRUMS.

QUALITY SINCE 1884

GENSEKE BROTHERS

RUBBER MATERIALS DIVISION

West 48th Place and Whipple Street Chicago 32, U.S.A.



2000 TON PRESSURE

MOLDS FIRESTONE GIANT TIRES

Moving mountains has become everyday practice with the help of modern earth moving equipment. This 2000 ton Baldwin Southwark Press molds the giant tires for such equipment.

Within your plant there may exist a need for something special in rubber molding presses. Call in Baldwin Southwark engineers. They'll help you find the answer.

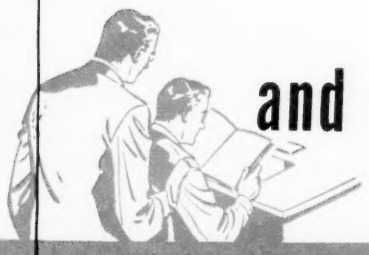
The Baldwin Locomotive Works, Baldwin Southwark Division, Philadelphia 42, Pa., U. S. A. Offices: Philadelphia, New York, Boston, Washington, Birmingham, Pittsburgh, Cleveland, St. Louis, Detroit, Chicago, Houston, San Francisco.

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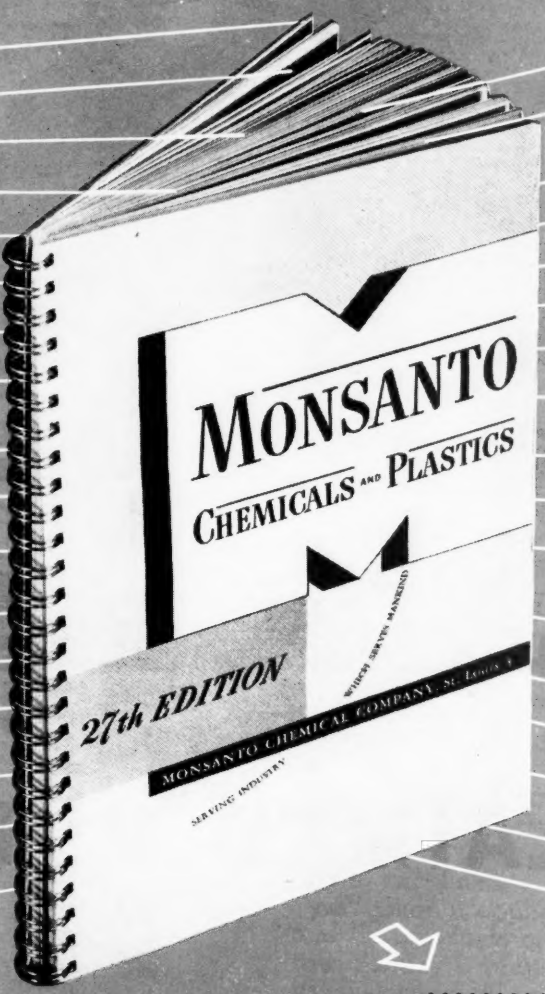
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If you are identified with any of the above 34 industries, this new and complete Monsanto Catalog should be on your desk . . . It contains 214 pages of valuable, detailed information on more than 400 Monsanto Chemicals and Plastics — a daily guide of definite help to everyone whose thinking is geared to increased production, greater economies, better methods and improved product salability . . . Send for your copy today . . . Fill in and mail the coupon, or write MONSANTO CHEMICAL COMPANY, 1700 South Second Street, St. Louis 4, Missouri.

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PEQUANOC RUBBER CO.

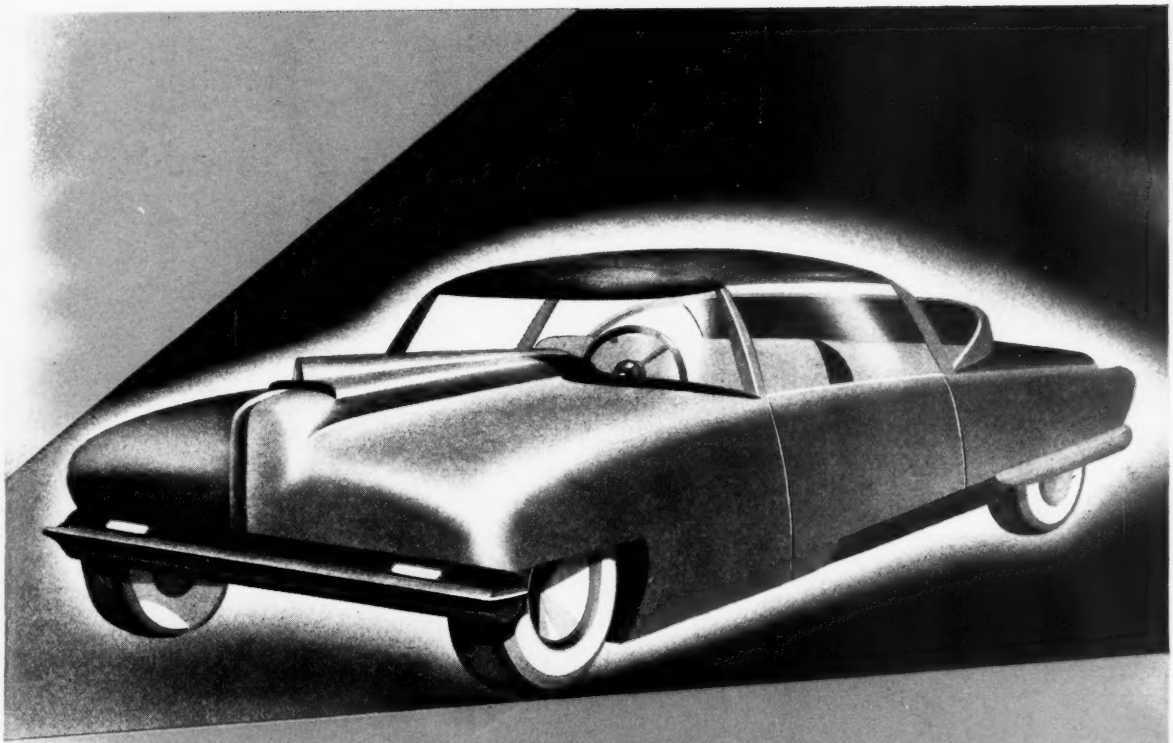
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Factory and Main Office: **BUTLER, NEW JERSEY**

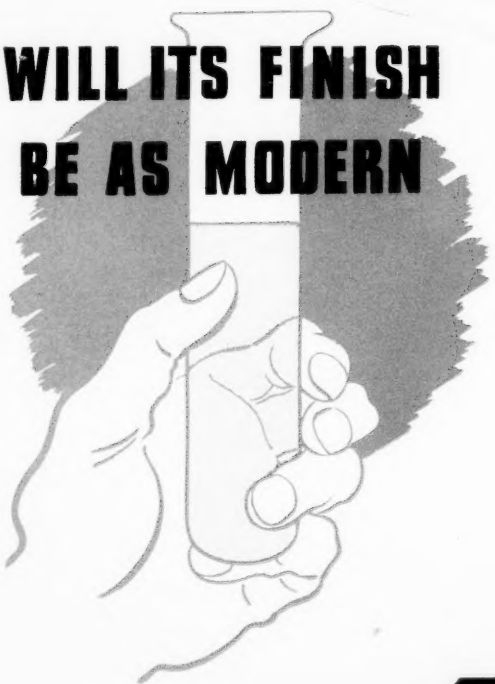
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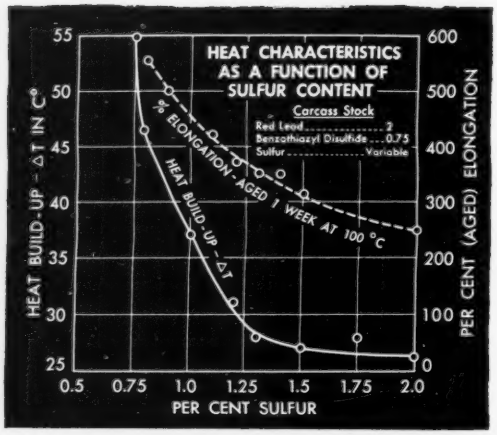


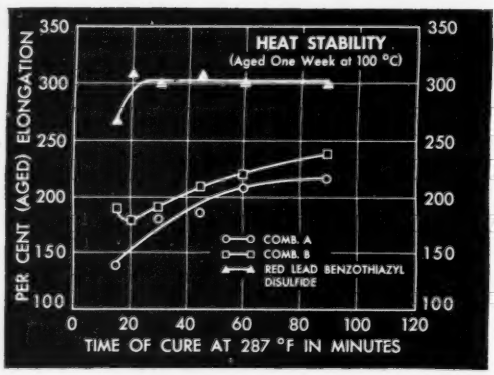
WILL ITS FINISH BE AS MODERN

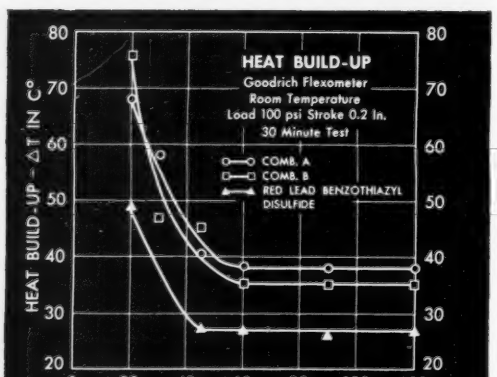


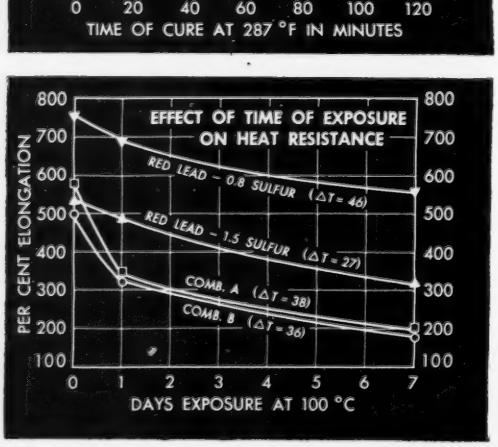
A product is only as good as its finish . . . for when the surface goes, value goes with it. Automobile makers know that and have worked "hand in glove" with Stanley Chemists to constantly improve car finishes. So the answer is "yes" when it applies to automobiles — and the products of other major industries Stanley is proud to number among its customers. A problem presented to Stanley Chemists incurrs no obligation. Write the Stanley Chemical Company, East Berlin, Connecticut, makers of Stanley Lacquers, Enamels, Synthetics and Japans.

Stanley Chemical









Heat build-up and heat stability... both improve when you compound GR-S with RED LEAD

Have you had difficulty making your GR-S carcass stocks both heat resistant and cool running?

If so, try the right combination of red lead, benzothiazyl disulfide and sulfur.

Its acceleration is sufficiently active and efficient to provide—concurrently—heat stability and low heat build-up.

Note the following table and the accompanying charts

FORMULA

GR-S (Institute)	100
S.R.F. Black	30
Zinc Oxide	3.0
Paraflux	7.5
No. 2 R.M. Red Lead	2.0
Benzothiazyl Disulfide	0.75
Sulfur	1.5

Physical Properties

T/287° F.	Tensile Strength	% Elong.	T-300	Shore	ΔT* in C°
15	1520	860	315	....	....
20	1630	780	390	46	49
30	1450	630	520	47	47
45	1330	530	570	47	27.5
60	1210	480	520	47	27
90	1130	500	590	47	26
120	1100	500	610	47	28

	Aged One Week at 100° C.			Aged 48 Hours at 100° C.	
T/287° F.	Tensile Strength	% Elong.	T-300	Shore	ΔT* in C°
15	910	270	.....	....	....
20	1080	320	1000	54	30.5
30	990	300	990	54	30.5
45	1050	310	1000	53	29.5
60	1130	300	1090	53	26
90	1090	300	1090	53	25
120	1160	340	1100	53	25

*Goodrich Flexometer operated at room temperature, 30 minute tests. Load 100 psi, stroke 20%.

SUMMARY OF ADVANTAGES

1. Imparts improved heat resistance—retention of elasticity.
2. Imparts improved heat build-up—cooler running.
3. Relatively faster curing rate.
4. Safe processing.
5. Excellent general physical properties.
6. Broad curing plateau—very little change in properties on overcures.
7. Economical.
8. Available.



The charts illustrated are taken from a report on recent experimental work by the Rubber Division of our Research Laboratories on the problem of heat build-up and heat stability in GR-S stocks. Write for your copy. The report is titled, "The Heat Problem in GR-S Carcass Stocks."

NATIONAL LEAD COMPANY New York, Buffalo, Chicago, Cincinnati, Cleveland, St. Louis, San Francisco; Boston (National-Boston Lead Co.); Pittsburgh (National Lead & Oil Co. of Penna.); Philadelphia (John T. Lewis & Bros. Co.).

THE BEST WAY TO MIX RUBBER IS ALWAYS GETTING BETTER



When Farrel-Birmingham first developed the Banbury mixer over 27 years ago, leaders in the rubber industry were quick to recognize internal mixing as the best method of breaking down, mixing and compounding rubber stocks.

After early installations had their proving period, the industry took advantage of the increased output and improved quality made possible by internal mixing, and the use of Banburys spread rapidly. Today there is scarcely a rubber plant in America that does not have one or more Banbury mixers, and they are used extensively throughout the world.

During this entire period, Farrel-Birmingham engineers have worked constantly to raise the efficiency of rubber processing. Not content with having developed a machine that revolutionized existing methods of breaking down, mixing and compounding rubber stocks, they have carried their work still further.

Improvements have been made in ways of installing Banburys which practically eliminate the manual handling of stock to and from auxiliary equipment. Other improvements—in operating techniques and in the design of the machine itself—have made the production of uniformly mixed, successive batches more and more automatic.

This work goes on. For the latest, up-to-the-minute information on the Banbury mixer, write for Bulletin No. 180.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONN.

Plants: Ansonia, Derby and Stonington, Connecticut; Buffalo, New York

Sales Offices: Ansonia, Buffalo, New York, Pittsburgh, Akron, Los Angeles, Tulsa, Houston, Charlotte

FB-280

Farrel-Birmingham

Technical Bulletin No. 18

on the Compounding of GR-S with Substantial Loadings of Zinc Oxide

100 Parts of Zinc Oxide with GR-S-10 (Rosin Soap Polymer)

ORIGINAL RESULTS

Time of Cure Min. at 45 Lb.	Tensile Strength (psi)	Per Cent Elongation	Modulus Load (psi) for Elongation of: 200%	300%	400%	500%	Permanent Set	Shore Hardness	Tear Resistance Tested at: Room Temp.	100°C.
4	1340	900	150	185	260	335	.25	33	89	56
7.5	1185	710	150	260	405	590	.13	38	75	54
15	1410	660	230	340	495	725	.12	40	67	61
30	1195	555	225	335	525	895	.09	41	67	43
45	1295	560	260	370	590	1000	.08	43	61	38
60	1055	550	225	340	530	830	.05	43	61	39
90	1150	555	220	370	555	890	.05	43	60	37

Time of Cure Min. at 45 Lb.	Shore Hardness	Goodyear-Healey Pendulum: Indentation in mm.	Goodyear-Healey Pendulum: Per Cent Rebound	Compression Fatigue (Goodrich Flexometer)*: Per Cent Initial Comp.	Running Time and Per Cent Permanent Set	Max. Temp. Rise °C.	Dynamic Compression: Initial	Dynamic Compression: Final	Cut-Growth Resistance Inches Failure at: 3,000 Cyc.	4,000 Cyc.
45	41	8.61	58.0	23.6	15'-7.4	33.2	7.4	12.9	.47	.63

* Test Conditions: 93 lb. Load. 0.25" Stroke. 100° C. Oven Temp.

"MBT-DPG" Acceleration

(Refer to Technical Bulletins No. 9, 10, 11, 13, 14, and 16)

CONTINUING the study of Zinc Oxide in the rosin soap polymer, MBT activated with DPG develops satisfactory stress-strain properties, and improved tear resistance both at room temperature and at 100°C., with low permanent set. The room temperature rebound of the GR-S-10 polymer is lower than that of standard GR-S, but at 100°C. the properties are reversed. This accounts for the generally lower heat build-up of GR-S-10 compounds in the Goodrich Flexometer.

COMPOUND NO. 18

GR-S-10	100.0
Sulfur	2.75
MBT	1.5
DPG	0.25
ELC Magnesia	5.0
Coumarone-indene Resin	7.5
Zinc Oxide	100.0



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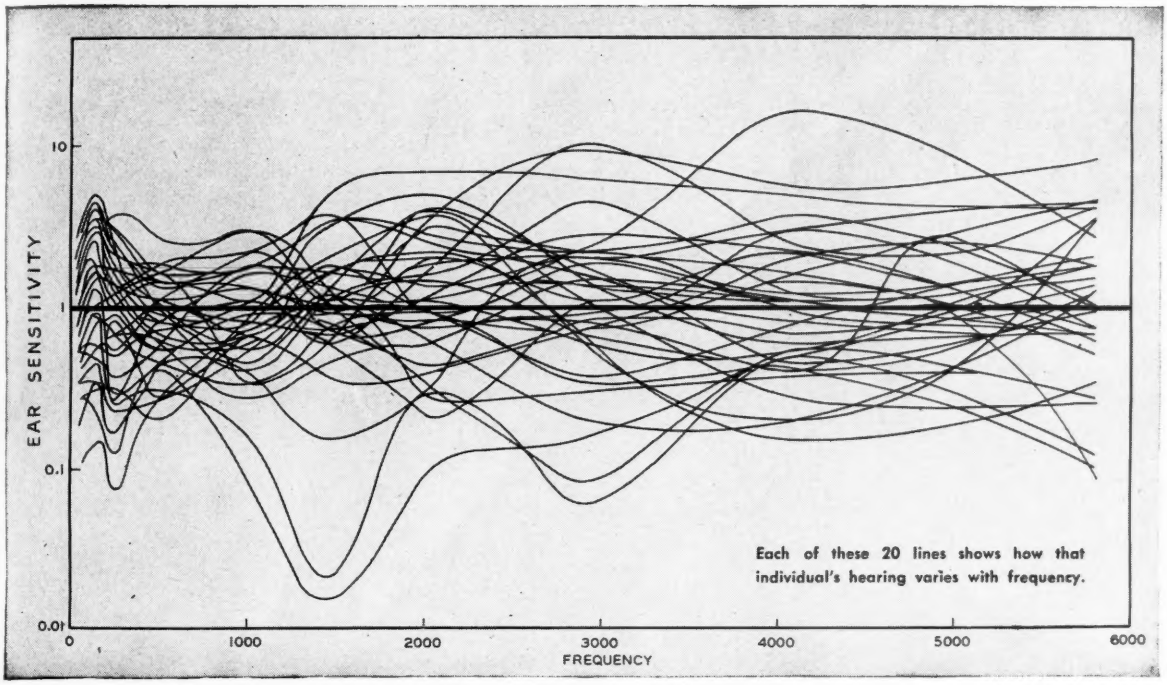
Write us for Technical information. Or, better yet, ask anyone who is using it!

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To measure is to know

Twenty-five years ago, one standard of sound power was the ticking of a watch, another was the clicking of two coins; and the measure was how far away the tick or the click could be heard. That test was made in measuring people's hearing, a field of interest to the Bell System scientists because the ear is the end-point of every talking circuit.

Accustomed to exact measurements, Bell scientists proceeded to develop a method of measuring hearing-sensitivity in terms which could be precisely defined and reproduced. After plotting hundreds of runs like those above, they decided on a particular sound intensity, representing an average "threshold of hearing," as a starting point.

The sounds delivered by a telephone line had previously been evaluated by listeners who compared their loudness with that of a standard source. There were wide variations in ears, as the chart shows, so the engineers replaced them by electrical instruments. When later their associates developed the Western Electric radio and public address systems, the necessary measuring circuits were promptly forthcoming. Addition of a standard microphone made a noise meter, widely used in quieting airplanes and automobiles.

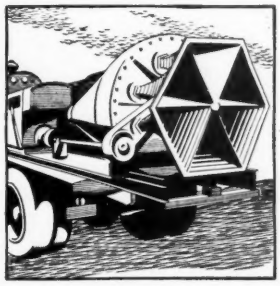
"Through measurement to knowledge," said a famous Netherlands scientist. The principle finds wide application in Bell Laboratories, whether the quest be for a way to measure sound, a new kind of insulation, or more economical telephone service.



Hearing was first measured reliably by engineers in the Bell Telephone Laboratories



For good reception, program loudness must stay within certain limits. Volume-meters help to hold it there



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Visible Speech, result of telephone research, turns sound into "pictures" that the deaf can read

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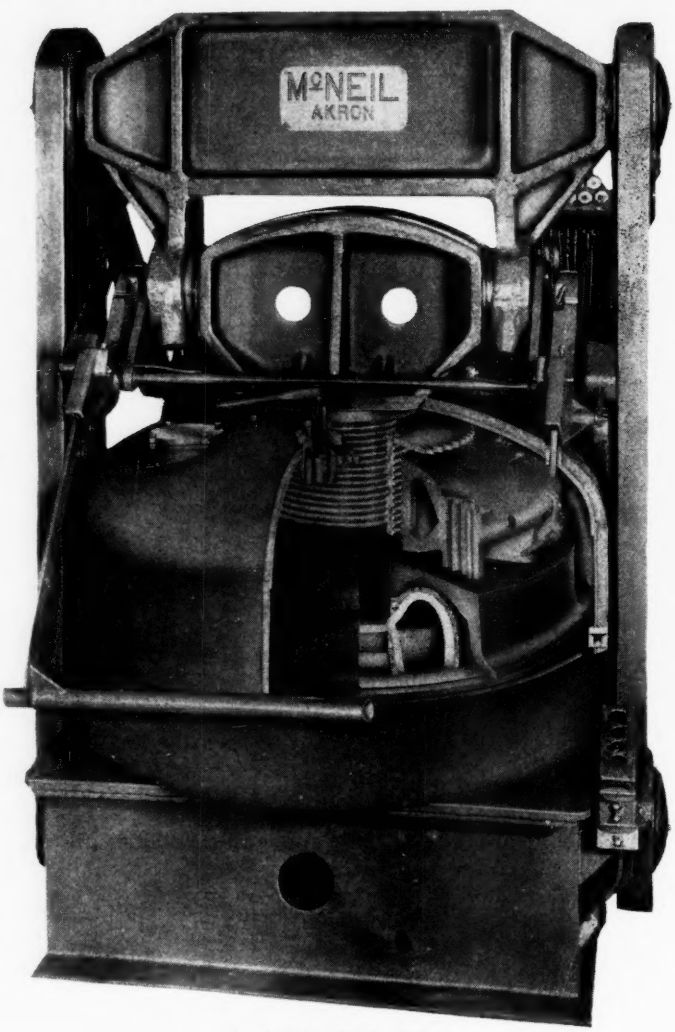
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4

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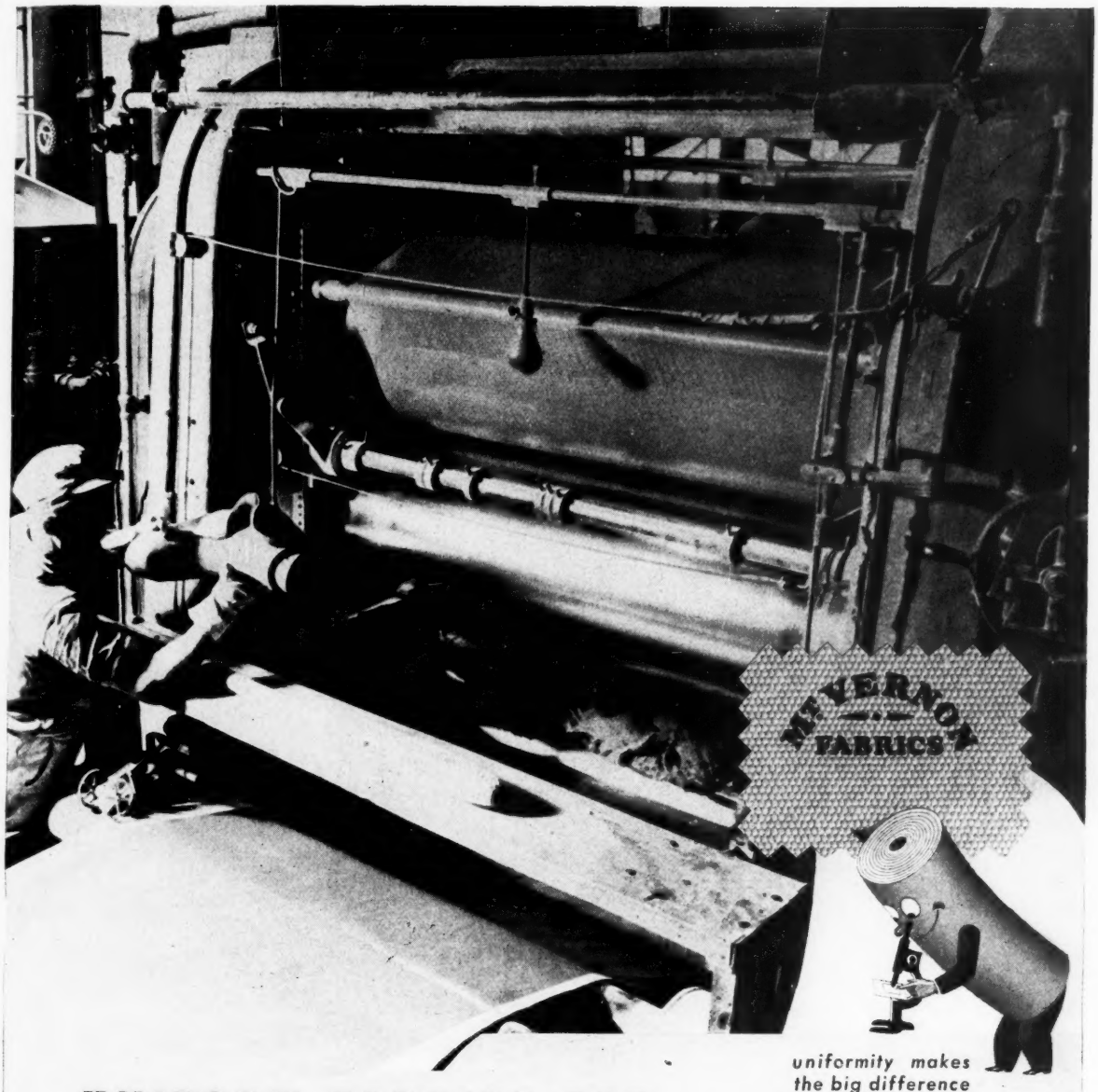
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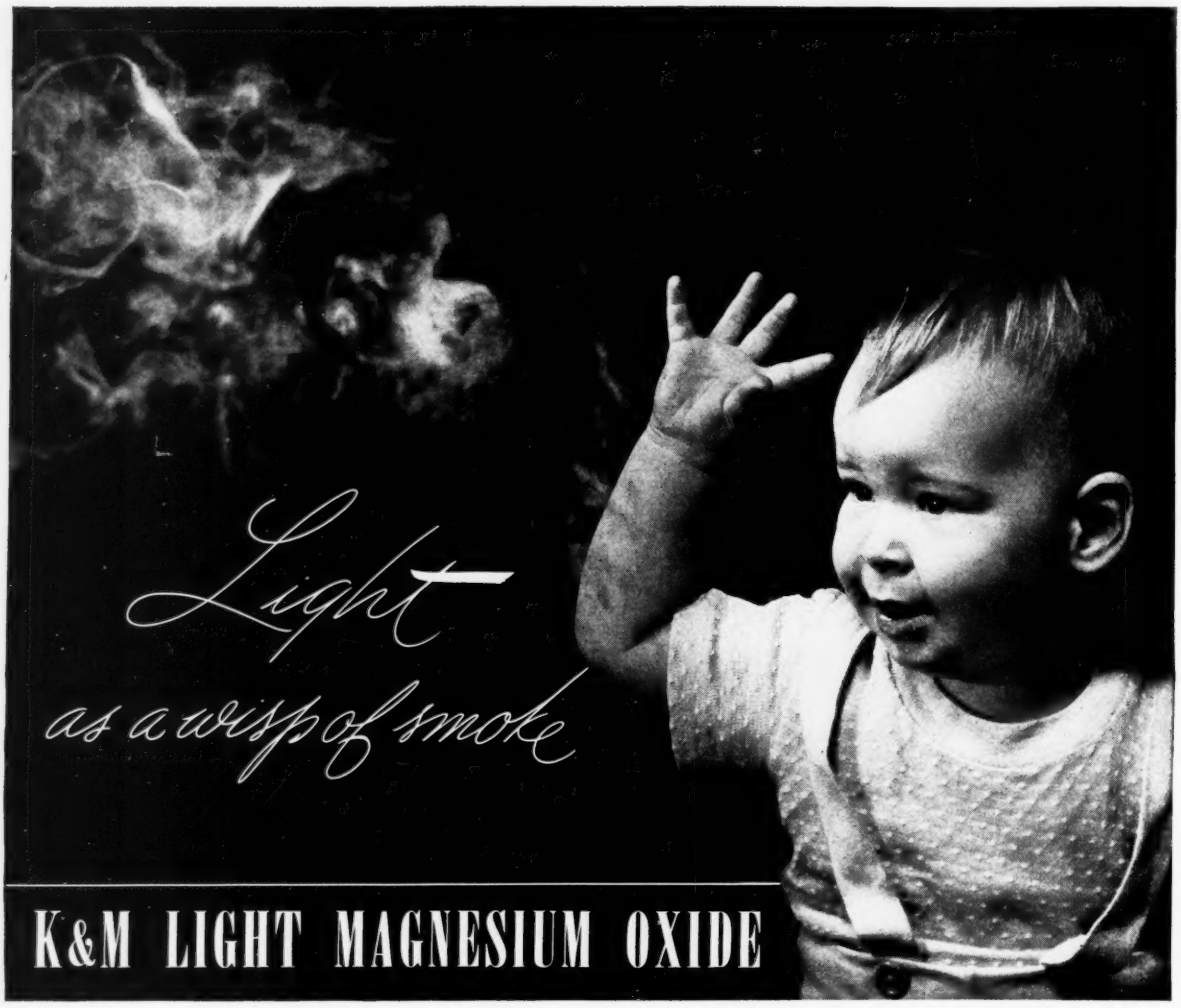
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Yes....

Philadelphia Reclaim

is Good!

★ For some months in these pages we've been saying that Philadelphia reclaim has an important place in American industry—because for many purposes it is the most economical compounding material that can be found; stable and dependable; compatible with natural and synthetic rubbers.

Industry in general must agree with our statements — for right now *there just isn't enough Philadelphia reclaimed rubber to meet the enormous demand.*

Our apologies won't do you any good. So instead of apologizing we'll pledge ourselves to produce every pound of Philadelphia reclaim that it's in our power to produce—and fast.

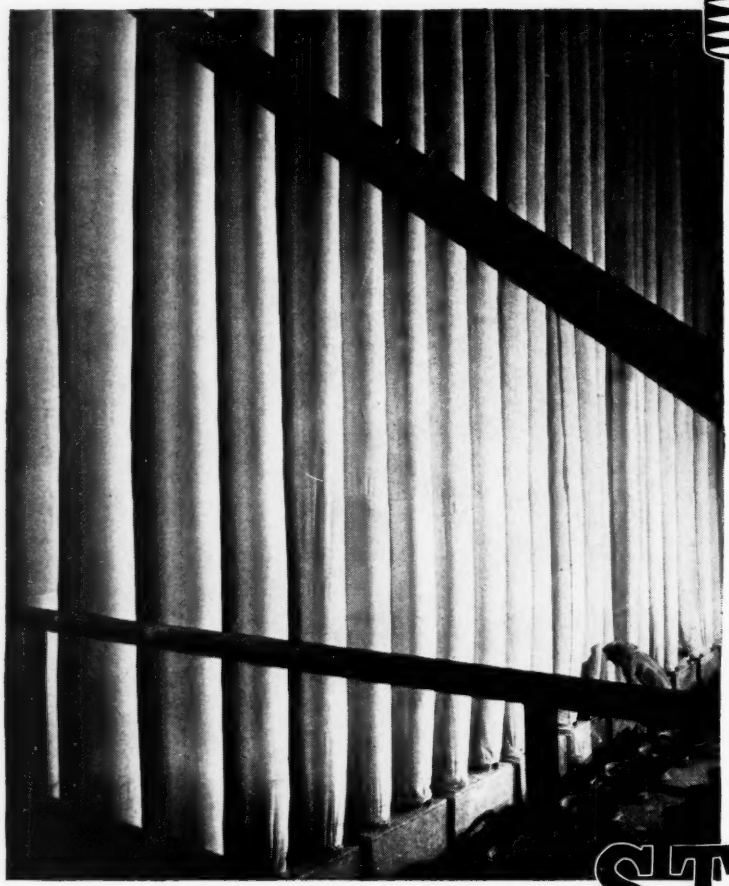
Peak demand should be reached soon, and that will give us a chance to catch up. So please be patient. And don't forget what you already have learned — that Philadelphia reclaim is *good.* B. F. Goodrich Chemical Company, Dept. BA-2, Rose Building, Cleveland 15, Ohio.

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Stage Setting

FOR AN IMPORTANT PRODUCTION





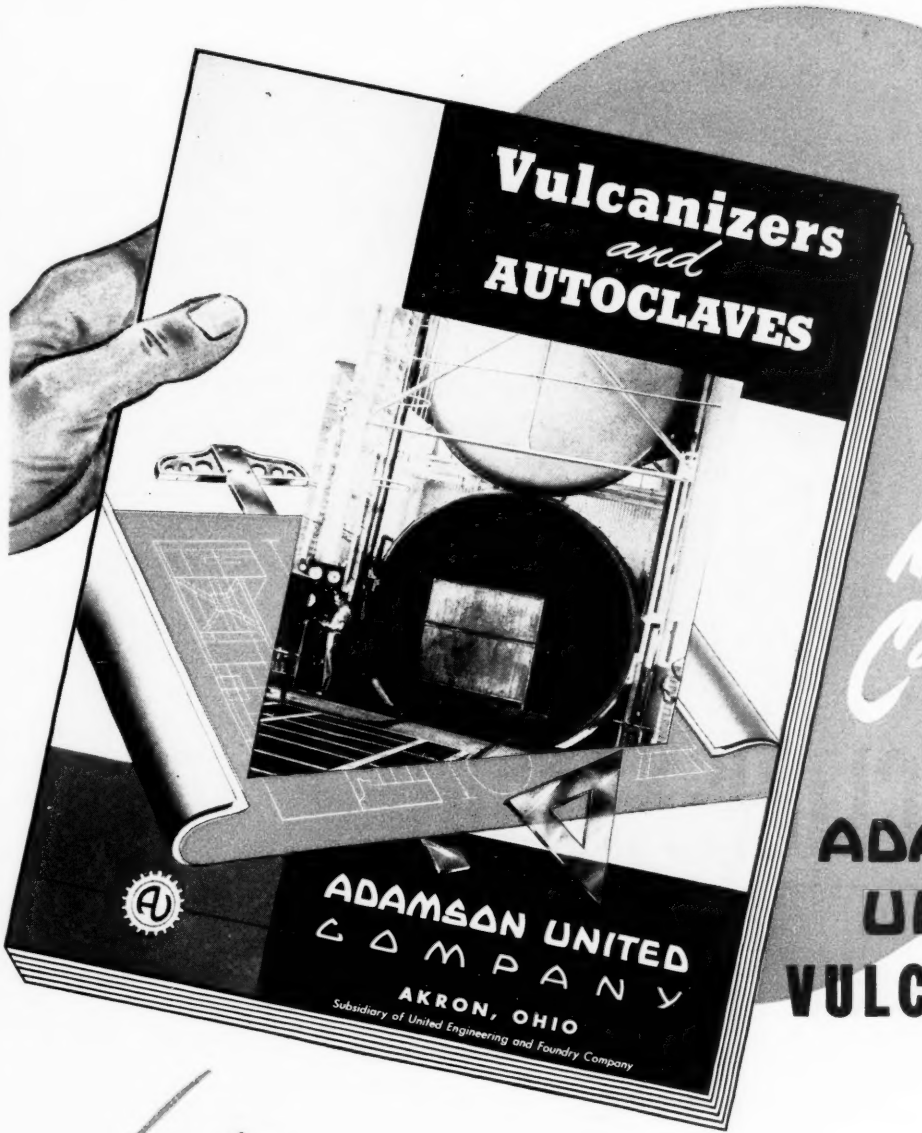
Even without unduly stretching one's imagination, this could be an imposing back-drop for a ballet.

• In reality, it *is* a stage setting for the final act in the production of St. Joe lead-free Zinc Oxides —showing a section of filter bags in the bag room of the St. Joseph Lead Company's zinc oxide plant at Josephtown, Pa. Originating in the Company's zinc mines at Edwards and Balmat in northern New York, the zinc oxide is now entering the last lap of its long and complicated journey from ore to finished product. From here, in paper bags or wooden barrels, St. Joe lead-free zinc oxides are shipped to the consuming industries where—by virtue of their uniform high quality—these St. Joe pigments, in turn, add to the inherent quality of the many products in which they are used.

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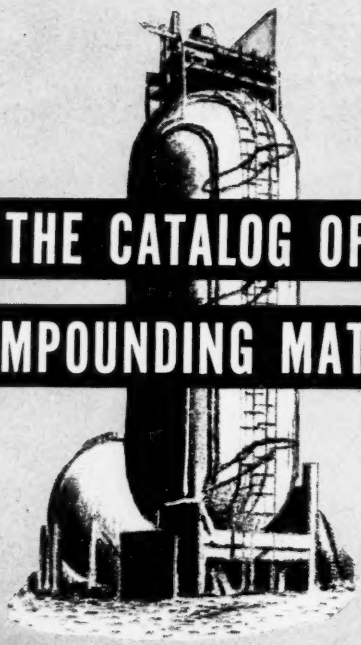
It illustrates and describes the principal types of vulcanizers and autoclaves developed and manufactured by Adamson United and successfully used by leading rubber companies here and abroad. Its pages reveal the wide scope of Adamson United designs and the vast range of sizes of equipment available to the industry. Whether for present information or as a source of future reference, this new catalog will prove valuable for the information it contains and as an outline of Adamson United vulcanizing equipment installed and in commercial operation throughout the world.

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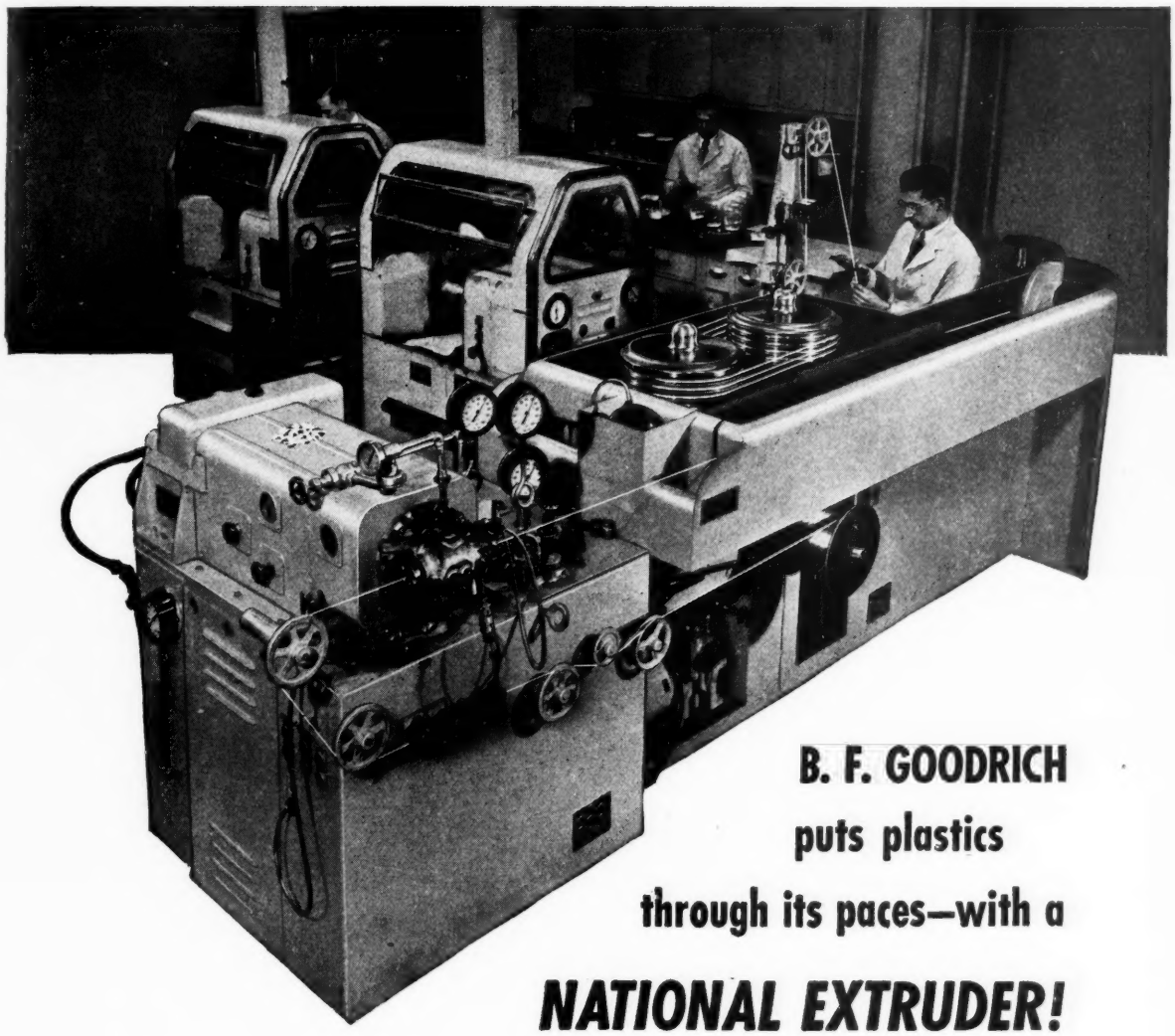
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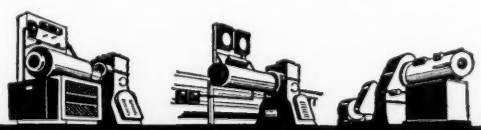


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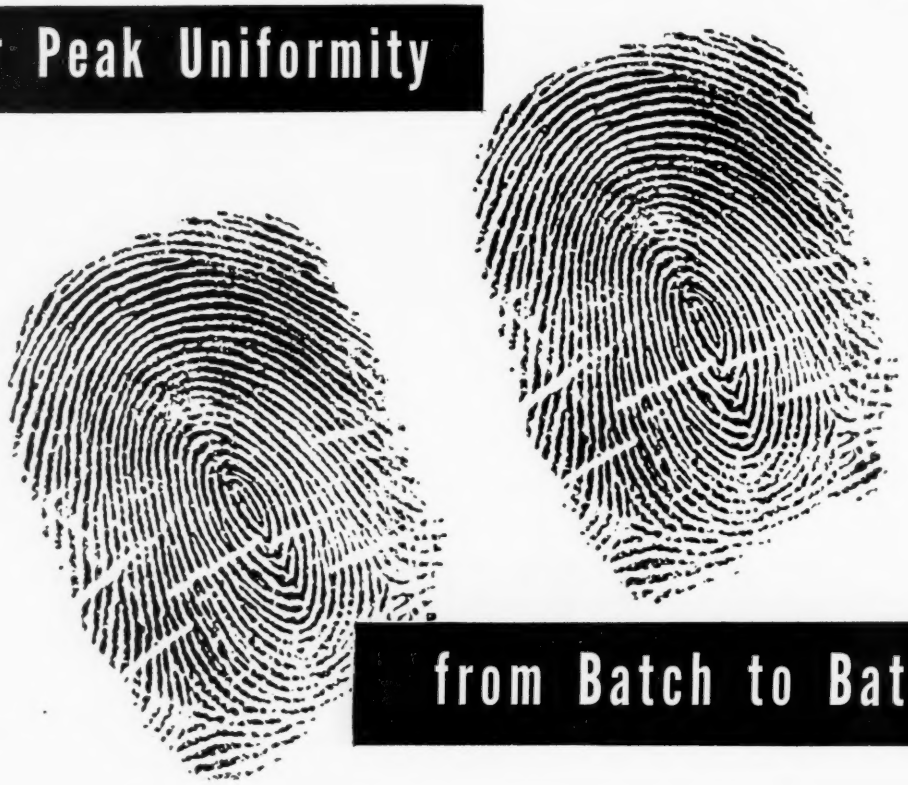
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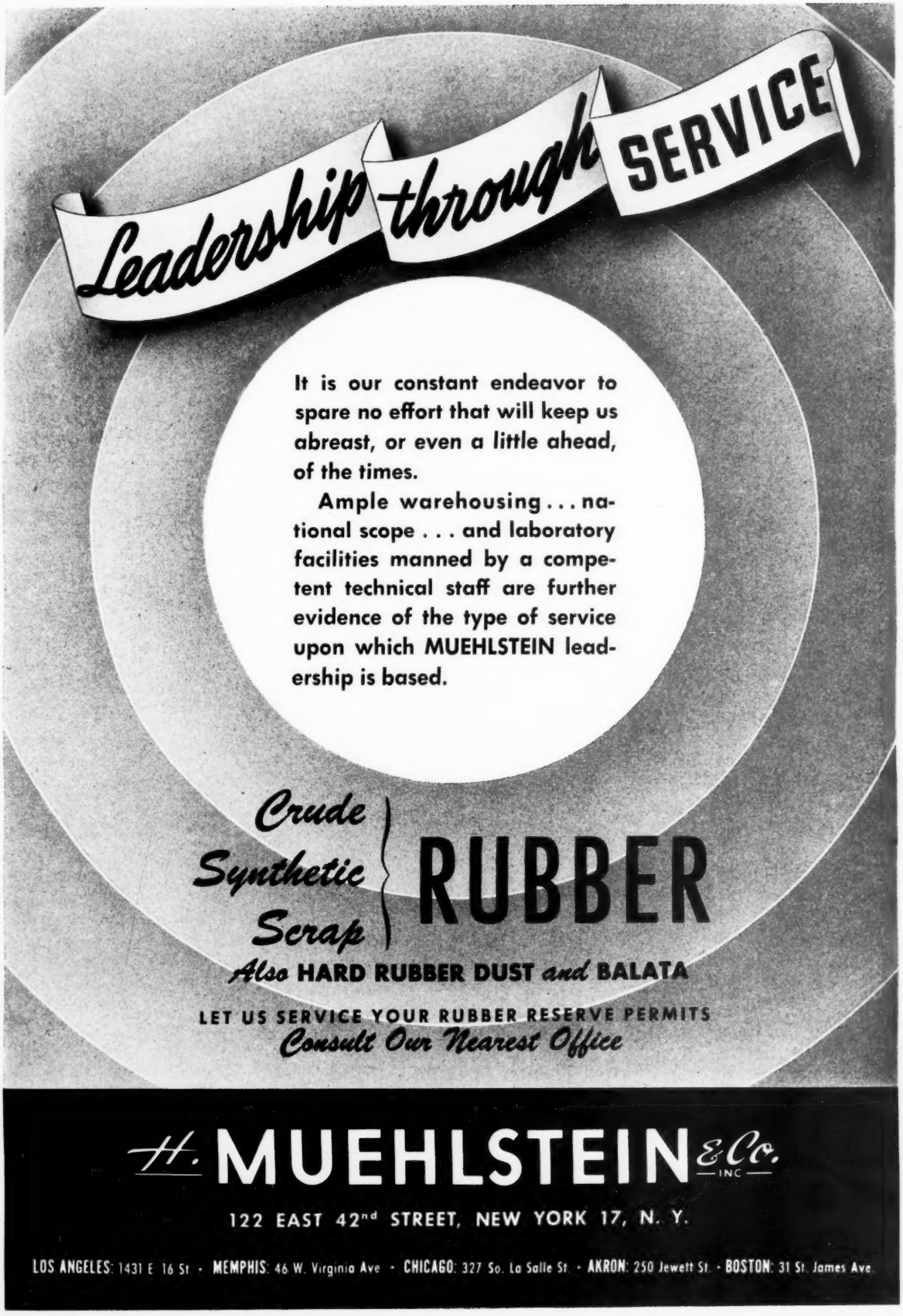
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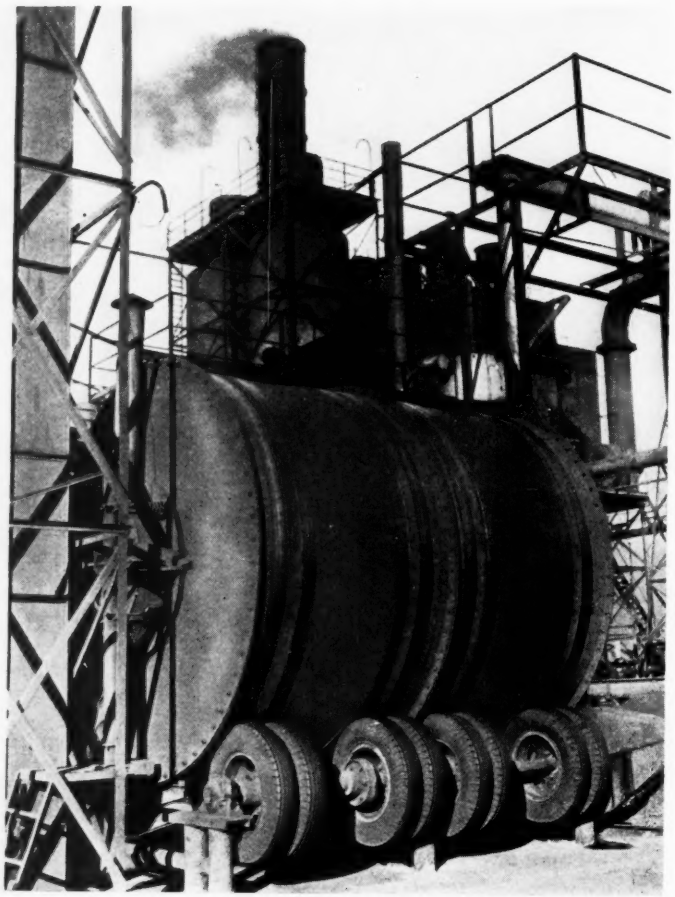
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Rubber Blacks

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ARROW TX	MPC
MODULEX	HMF
ESSEX	SRF

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J. M. HUBER, Inc.

460 West 34th Street
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February, 1946

Volume 113 Number 5

A Bill Brothers Publication

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Impact of Strategic Air Attack on the German Rubber Industry

E. W. Pittman,[1] G. O. Trenchard,[2] M. J. Tierney,[3] W. C. Asbury[4]

OPERATING under a Presidential directive, the Oil, Chemical and Rubber Division of the U. S. Strategic Bombing Survey investigated the results of the Allied strategic air attack on the German oil, rubber, and chemical industries. The members of this Division, comprising civilians from American oil, chemical, and rubber companies and officers and enlisted men from the U. S. Armed Services, inspected plants, interrogated officials, and unearthed and studied documents in Germany both before the fighting stopped and after V-E Day in an effort to get a comprehensive picture of production in these industries. The following summarizes the overall production situation on rubber as reported by the authors, all members of the U.S.S.B.S.

The German Rubber Industry

In World War I, Germany learned thoroughly the necessity of having enough rubber to wage war successfully. She understood clearly the importance of rubber for airplanes, tanks, and motorized transport. Yet she entered World War II on a shoestring, as far as rubber stocks were concerned.

Before the war Germany was the third largest consumer of the world's rubber supplies, ranking after the United States and the United Kingdom. Per capita, Germany used roughly a fourth as much natural rubber as the United States, compared to one-fifteenth of United States consumption of oil. Germany's prewar imports and consumption of natural rubber are shown in Table 1.

TABLE 1. GERMAN IMPORTS AND CONSUMPTION OF NATURAL RUBBER
(Metric Tons* per Year)

Year	Imports	Consumption
1936	73,415	73,440
1937	97,580	87,720
1938	97,155	97,155
1939	84,801	81,382

* Equals 2205 pounds, or 0.9842 long tons. Metric tons are used throughout this report in referring to rubber and its products.

In comparison, the United States rubber industry in 1939 consumed about 600,000 long tons of natural rubber.

Development of Synthetic Processes

To make up her deficiency in rubber in World War I, Germany developed Methyl rubber, a substitute so soft that cars with tires made of it had to be jacked up at night. After that war I. G. Farberindustrie searched for a better substitute. First it developed a fair synthetic based on butadiene alone; by 1930 it had developed Buna S, a satisfactory tire rubber, and an oil-resistant rubber for special uses.

The basic raw material for all these rubber substitutes was coal, which assured Germany of self-sufficiency in case war cut her off from seaborne supplies. The main raw materials used in the synthesis of Buna S are butadiene and styrene. Butadiene was made from acetylene derived either from calcium carbide or from the gases from coal hydrogenation; while styrene was derived from coal tar, benzene, and ethylene. Buna S manufacture is also heavily dependent on coal as a source of electric power since it takes 18,000 to 19,000 kwh. of power to produce a ton of Buna. The whole synthetic rubber program consumed as much electric power as the great city of Philadelphia. Despite the abundance of coal in Germany the industry was vulnerable because it was closely integrated and interrelated with the chemical and synthetic oil industries.

The largest synthetic rubber plant in Germany, at Schkopau, depended on the nearby Leuna synthetic oil and chemical plant for hydrogen for the conversion of aldol to butylene glycol and hydrogenation of acetylene to ethylene. The second largest plant, at Hüls, depended mainly on gases from nearby coal hydrogenation plants. The rubber processing industry was dependent on certain plasticizers which were made in a few chemical plants. The rubber industry thus leaned on the oil and chemical industries. But it bolstered them by contributing an aviation gasoline blending agent—diethyl benzene—and aviation lubricants, made by ethylene polymerization, to the supplies of the Luftwaffe.

Rubber Processing Industry

Before the war the German rubber processing industry consisted of some 278 rubber factories, of which 53 were major producers. The most important units were:

(a) Eleven tire factories, four producing tires, seven producing both tires and mechanical goods.

(b) Thirteen mechanical goods factories in addition to the seven combination factories mentioned above (a).

(c) Twenty-nine important producers of sanitary and seamless rubber goods, shoes, heels, rubberized fabrication, thread, adhesive, etc.

In addition to processing 73,000 to 97,000 metric tons of natural rubber a year before the war, Germany also proc-

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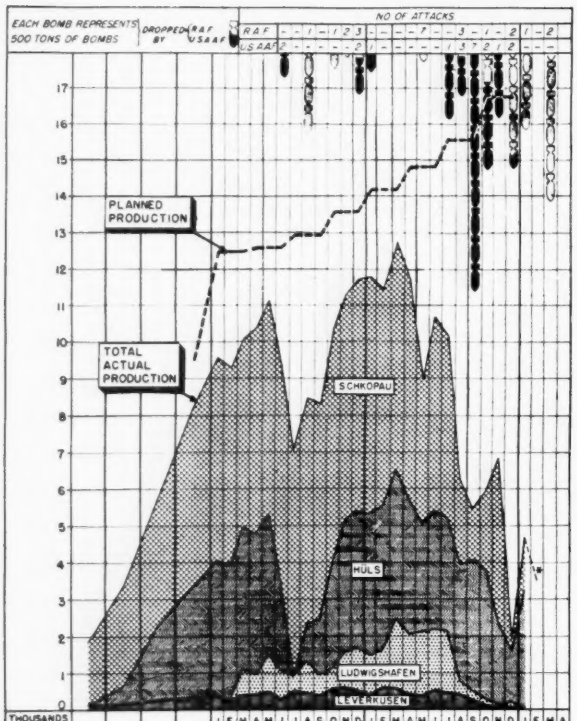


Fig. 1. Planned and Actual Production and Bomb Tonnages Dropped on Synthetic Rubber Facilities in Greater Germany

essed between 29,000 and 35,000 tons of reclaimed rubber, mainly for use in mechanical goods.

The German prewar situation on carbon black, which she started to produce domestically in 1933, was quite satisfactory. In other raw materials (mineral oils, diverse chemicals, accelerators, pigments, and textile fibers) Germany was either self-sufficient or had developed suitable substitutes.

War Plans for Rubber—Synthetic Rubber Industry

In anticipation of war Germany's new synthetic rubber industry was given a substantial tariff protection, culminating with a duty of 30.9¢ per pound imposed on March 21, 1938. This compares with a 1939 New York market price for imported natural rubber of 15 to 16¢ a pound during the first eight months. In addition the I.G.'s Buna development was subsidized directly, and under the 1937 four-year plan the government authorized the construction of three 25,000-ton synthetic rubber plants, besides the pilot plant at Leverkusen which was already in operation. The planned capacity of all these plants was slightly less than Germany's prewar needs and was increased before construction was completed on the first two plants, as follows:

(a) Capacity at Schkopau, where operations began in 1938, was increased to 72,000 metric tons. Schkopau's acetylene came from calcium carbide made on the site, and the plant's annual Buna production rate stood at 25,000 tons by September, 1939.

(b) By the time construction began at Hüls in 1938, its design rating was 48,000 tons. The acetylene for Hüls was produced by the electric arc process from gases which came mainly from the nearby Scholven and Gelsenberg hydrogenation plants.

Late in 1939 the third plant, at Rattwitz near Breslau, was approved, but it was never completed because after the easy victory in France the High Command and the German Ministry for Economic Affairs decided to rely instead upon cheap natural rubber from the Japanese. By September, 1940, the government had changed its mind and pressed for a new plant at Ludwigshafen. This plant, designed to produce 30,000 tons of rubber annually from a new butadiene synthesis based on the reaction of acetylene and formaldehyde, tied Buna production to methanol (via formaldehyde) and further interrelated the Ludwigshafen-Oppau production complex. This plant was not in full operation until September, 1943.

The last step in the Buna plan involved the erection of a 36,000-ton plant (together with chemical and oil plants) at Auschwitz, Poland, believed to be safe from air attack. Only a few parts of this plant operated before its capture. Including the 6,000-ton pilot plant at Leverkusen, the ultimate planned capacity of the synthetic rubber plants was 192,000 metric tons a year, about twice Germany's prewar consumption of natural rubber.

Rubber Processing Industry

In terms of total rubber consumption, including reclaim, the prewar capacity of the rubber processing industry was about 15,000 metric tons a month. Of this capacity 57% was devoted to mechanical and technical goods, 33% to tires (including solids), 7% to bogie wheels, tank treads, and blocks, and 3% to camelback and repair materials.

No new rubber manufacturing plants were built after war broke out, but capacity of existing machinery was increased by some 20%—part for new war products, part to offset production difficulties incident to conversion to synthetic rubber. In general, however, after allowing for the greater difficulty of handling synthetics, Germany's war potential in processing was no greater than her prewar capacity.

Government Controls

Dr. Krauch, Commissioner General for Problems of the Chemical Industry, was coordinator of controls over synthetic rubber as well as those over synthetic oil, chemicals, and explosives. The Government Board for Rubber administered processing-industry policies laid down by ministry offices; while the Industry Group—Rubber *(Fachgruppe-Kautschuk)* handled technical problems such as standardization and costs.

Stock Position

Dr. Otto Friedrich, Deputy Director of the Government Board for Rubber, reports that a frantic search of all Europe in August, 1939, netted only 7,000 tons of natural rubber from Holland. At the end of that month Germany's stocks amounted to only 2.4 months' prewar consumption (19,383 tons, 76% natural rubber, 24% Buna). Moreover the stock of reclaim was 4,969 tons, equivalent to only two months' supply.

Because the synthetic rubber industry was still in its infancy and the rubber processing industry not yet converted to synthetics, the Germans gambled even more on rubber stocks than on oil stocks. And the same gamble was taken with finished rubber products: on August 31, 1939, the finished tire stocks of 500,000 represented only 1.2 months of peacetime consumption.

Loss of Production and Air Attacks—Synthetic Rubber Industry

Priority Considerations

The German synthetic rubber industry formed a highly vulnerable target system concentrated throughout the war in a few large plants. Yet, although certain of the plants were attacked sporadically as priority objectives, the industry was not subjected to prolonged or concentrated attack.

Until March, 1943, when the Ludwigshafen plant came into partial operation, there were only two large rubber plants (Schkopau and Hüls) and one small plant (Leverkusen). Thereafter, since Auschwitz was captured by the Russians before getting into full production, there were only four plants. But synthetic rubber plants were not

placed in the first bombing priority category until November 10, 1943, and even then they were given fourth place in the category. They came off the priority list entirely again in May, 1944, when oil was given top priority. Hüls was attacked once and Leverkusen once as Number 1 priority targets of the Eighth Air Force. Ludwigshafen was repeatedly attacked by the RAF and the Eighth, but apparently the rubber plants were never the primary aiming point. The Auschwitz plant was a Number 1 priority target for the Fifteenth Air Force three times.

Attack Data

Table 2 shows the distribution of the 19,458 short tons of bombs dropped at synthetic rubber plants.

TABLE 2. BOMBS DROPPED AT SYNTHETIC RUBBER PLANTS

Period	Bomb Tonnage Dropped By USAAF	By RAF	Total
Sept. 1, 1939, to June 10, 1943	0	355	355
June 10, 1943, to Nov. 10, 1943	454	1,714	2,168
Nov. 10, 1943, to May 12, 1944	1,087	112	1,199
Subtotal	1,541	2,181	3,722
May 12, 1944 (oil offensive) to May 8, 1945	9,264	6,472	15,736
TOTAL	10,805	8,653	19,458

Over 75% of this tonnage was dropped at Ludwigshafen, where it was aimed primarily at oil installations, though synthetic rubber production was also jeopardized. Of the total bombs dropped at both the rubber and oil industries, rubber took only one-tenth as much as oil. The effects of direct and indirect bombing on synthetic rubber are shown in Figure 1.

Production Loss Before Oil Offensive

Between June 10 and November 10, 1943, synthetic rubber targets had a Number 3 priority. At the start of this period Schkopau and Hüls were nearly up to rated capacity (5,800 and 3,800 metric tons a month, respectively) and Ludwigshafen had come into partial production. Stocks of natural and synthetic rubber were down to one month's supply (9,000 tons). When the Eighth Air Force attacked Hüls on June 22, 1943, it shut down the plant entirely for one month, causing a loss of 12,000 tons of production. The end result of this attack was to send total rubber stocks, excluding reclaim, to a low of 6,500 tons by September (see Figure 2),[5] forcing the government planners to reduce the stock of finished tires to 1½ months' supply and holding production of tires and other rubber articles at levels 10 to 15% below schedule for the last six months of 1943.

By November 10, 1943, when synthetic rubber went into the first priority category, the industry had recovered so that stocks were slightly higher than the September low, and production was back to 11,000 tons a month. From then until May 12, 1944, most of the raids concentrated on Ludwigshafen, but that plant nonetheless worked up to 85% of rated capacity, and the entire industry reached an all-time peak of 12,787 tons in March before a decline set in.

Loss of Production During the Oil Offensive

After the start of the oil bombing offensive, the decline in synthetic rubber production was not unlike that in aviation gasoline, as Table 3 shows.

Thus, though only 15,736 short tons of bombs were dropped at its plants, the synthetic rubber industry, because of its integration with oil and chemicals, suffered a crushing blow. This is what happened:

(a) Schkopau production was lost because the Leuna hydrogen producing facilities were knocked out. The meager 2.6% of Leuna's hydrogen earmarked for Schkopau was its sole supply and stood at the head of Leuna's priority list. Despite all Leuna could do, Schkopau lost 43,600 tons of rubber production (compared to its January-April average) during the oil offensive.

[5] Source: Dr. Otto Friedrich, deputy director, **Reichstella Kautschuk.**

TABLE 3. PRODUCTION INDEX BASED ON FIRST FOUR MONTHS OF 1944 AS 100

	Synthetic Rubber	Aviation Gasoline
January-April, 1944	100	100
May, 1944	76	92
June, 1944	91	31
July, 1944	85	21
August, 1944	53	10
September, 1944	42	6
October, 1944	49	12
November, 1944	48	29
December, 1944	15	15
January, 1945	40	6.5
February, 1945	30	0.3
March, 1945	28*	0.02
April, 1945	6*	0

Source: Documents from Dr. Speer, German Minister of Armaments and War Production.
*USSBS estimates.

(b) Hüls lost production because of its dependence on gas from the bombed synthetic oil plants at Scholven and Gelsenberg. This was partially offset by bringing in natural gas from Bentheim and acetaldehyde from Bavaria.

(c) Ludwigshafen and Leverkusen rubber production dropped because of the bombing of oil plants at the former and chemical plants at the latter.

From the start of the oil offensive to the end of the war, the overall loss of Buna production compared to the first four months of 1944 amounted to 75,000 tons.

Total Loss of Production

It is difficult to evaluate satisfactorily the total loss of synthetic rubber production because, while the industry was subject to some attack from 1941 on, it was continually being expanded. However the estimated losses of 12,000 metric tons from the June 22, 1943, attack on Hüls, plus a 4,000-ton loss from previous Hüls attacks, plus the estimated 75,000-ton loss during the oil offensive, adds up to 91,000 tons of lost production.

This figure is conservative when actual *versus* planned production is taken into account. The plan put forward in early 1941 contemplated an ultimate annual production

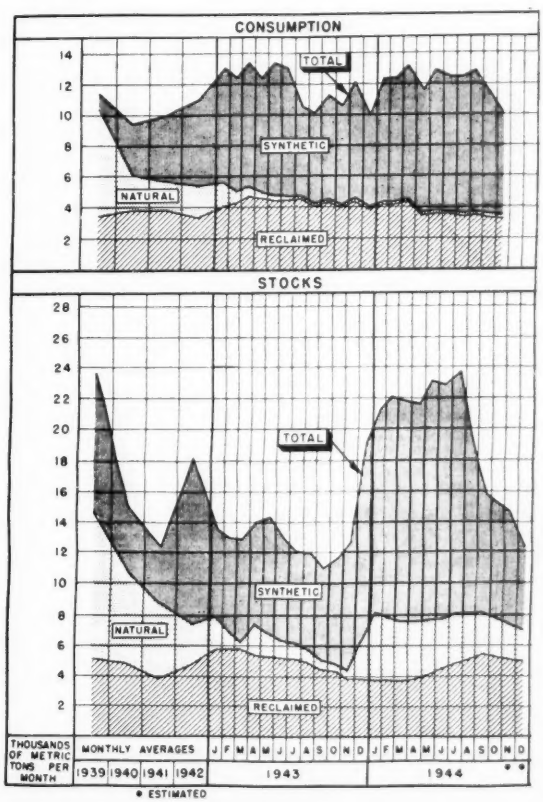


Fig. 2. Rubber Consumption and Stocks in Greater Germany

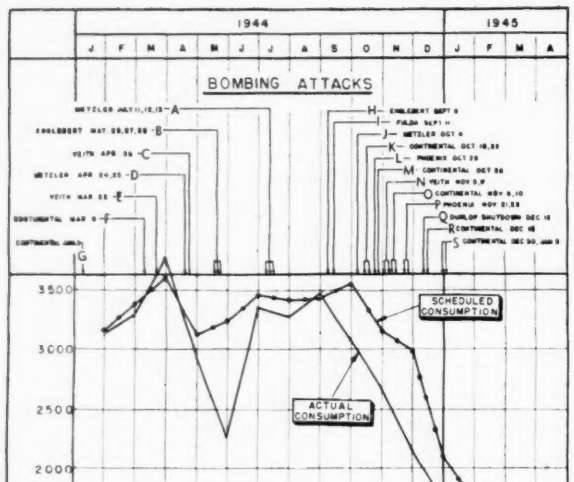


Fig. 3. Scheduled vs. Actual Rubber Consumption in German Pneumatic Tire Production

A. Metzler, July 11, 12, 13
B. Englebert, May 25, 27, 28
C. Veith, Apr. 26
D. Metzler, Apr. 24, 25
E. Vieth, Mar. 22
F. Continental, Mar. 9
G. Continental, Jan. 3
H. Englebert, Sept. 8
I. Fulda, Sept. 11
J. Metzler, Oct. 4
K. Continental, Oct. 18, 22
L. Phoenix, Oct. 25
M. Continental, Oct. 26
N. Veith, Nov. 5, 9
O. Continental, Nov. 6, 10
P. Phoenix, Nov. 21, 22
Q. Dunlop Shutdown, Dec. 12
R. Continental, Dec. 15
S. Continental, Dec. 30, Jan. 5

of 200,000 tons by the last quarter of 1944. Figure 1 shows this plan and how production lagged behind it. On this basis the total production loss was 183,000 tons. Even if the actual loss was only the 91,000 tons already mentioned, each of the 19,458 short tons of bombs expended on synthetic rubber resulted in production loss of 4.7 metric tons.

Loss of Production and Air Attacks— Rubber Processing Industry

Summary

Throughout the war the German rubber processing industry operated on a hand-to-mouth basis. Because stocks were always relatively tight, the slightest loss in rubber production made itself felt immediately in finished product output. Thus the June, 1943, Hüls attack reduced tire and rubber boot production at Phoenix by about 50% within a month; while compound consumption at the huge Continental plant dropped more than 40%. The drop in production was rapid in both cases. A drastic reduction, about 25%, had to be made in allocations of finished products as a result of this raid on Hüls.

The processing industry, particularly tire plants (which enjoyed a Number 3 Eighth Air Force bombing priority between June 10 and November 10, 1943), was also subjected to direct attack, as shown in Table 4.

Though only 443 short tons of bombs were aimed at tire plants *per se*, according to available information, many tire plants also underwent area attacks because they were located in cities. The effects of attacks on production of pneumatic tires of various types are shown in Figures 3[6] and 4[7]. Before the bombing of Hüls in the middle of 1943, normal consumption of rubber for pneumatic tires was 3,300 to 3,400 tons a month. These charts show that, in spite of some attacks and the hand-to-mouth stock situation, the drop in rubber consumption for tires did not start until September, but that from then on serious and rapid drops occurred in the production of heavy-duty truck, airplane, and passenger-car tires.

TABLE 4. ATTACKS ON THE RUBBER PROCESSING INDUSTRY

Period	Bomb Tonnage Dropped By USAAF	By RAF	Total
Sept. 1, 1939, to June 10, 1943	0	2	2
June 10, 1943, to Nov. 10, 1943	286	0	286
Nov. 10, 1943, to May 12, 1944	0	0	0
Subtotal	286	2	288
May 12, 1944, to May 8, 1945	155	0	155
TOTAL	441	2	443

Effects of Bombing on Production

Although there is substantial disagreement among sources on finished product production, particularly as to the latter months of the war, following are the estimated results of the air attacks on the industry:

(a) The pneumatic tire fabricating plants during the period from January 1, 1944, to March 1, 1945, were able to convert only 38,117 tons of rubber into tires, and USSBS estimates that the total was probably no more than 40,000 tons at the war's end. This amounts to a loss, over the 16-month period, of about 14,000 tons, or four-months' normal consumption (as compared with a normal of 3,400 tons per month).

(b) The loss in actual tires produced for the 12 months of 1944 is summarized in Table 5.

[6] Sources: Rubber statistics, **Reichstelle Kautschuk**; bombing data, **Reichministerium for Bewaffnung und Munition** and USSBS Plant Investigations.
[7] Source: Records of **Reichstelle Kautschuk**.

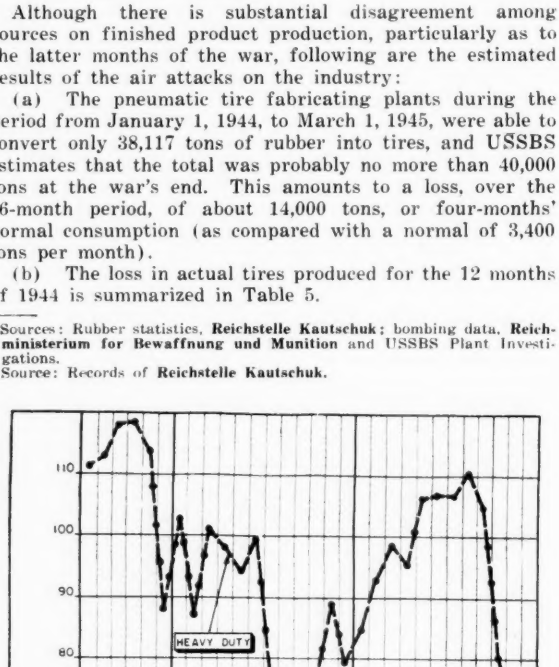


Fig. 4. Monthly German Tire Production by Major Types

TABLE 5. LOSS IN TIRE PRODUCTION FOR 1944

Article	Loss from Scheduled Production	Loss from Best Month
Airplane tires	50,876	144,540
Heavy-duty truck and bus tires	134,323	217,644
Total passenger tires	31,215	197,710

(c) The loss in mechanical goods cannot be precisely calculated, but it is reflected in the over-all consumption of rubber. See Figure 5.[8]

(d) The total consumption of natural, synthetic, and reclaim rubber from the start of the war until January 1, 1945, compares, as follows, with (1) the industry's capacity in its best month (March, 1943) projected over 64 months and (2) a monthly capacity for all types of rubber of 15,000 tons (according to Dr. Friedrich):

Actual Consumption Metric Tons	Best War Rate, Tons		Rated Capacity, Tons	
	Capacity	Loss	Capacity	Loss
676,582	857,600	181,018	960,000	283,418

The estimated loss of 283,418 tons in rated capacity is equivalent to 15,000,000[9] heavy-duty tires. Main items contributing to the loss are: (a) destruction of rubber processing plants, (b) lack of Buna rubber resulting from bomb damage to synthetic rubber plants, (c) interferences with transportation of raw material, (d) withdrawal of trained personnel from the rubber processing industry, (e) lack of power at processing plants because of air attacks, etc. Several examples of difficulties in transporting raw materials from the synthetic rubber plants to the processing plants were observed. At Schkopau, in the middle of 1944, 1,500 tons of Buna could not be moved because of lack of transportation. At Continental the lack of raw material deliveries caused the available supplies to fall from an equivalent of six weeks' production in January to two days' in December, 1944.

Ebb and Flow of Germany's Rubber Position, Consumption, and Stock Level

CONSUMPTION-PRODUCTION BALANCE: RAW RUBBER. Table 6 gives an overall consumption-production balance for the German natural and synthetic rubber industry from the start of the war to January 1, 1945. It is based on German statistics up to the end of October, 1944, and USSBS estimates for the rest of 1944. Thereafter conditions in German industry were too chaotic for further estimates.

TABLE 6. GERMAN CONSUMPTION-PRODUCTION BALANCE: RECLAIM EXCLUDED

Start of War to January 1, 1945

Rubber	Metric Tons	%
Supply		
Natural rubber imports	79,325	14.9
Synthetic rubber production	439,687	82.8
Drain on stocks	12,113	2.3
TOTAL	531,125	100.0
Consumption		
Exports of Buna and natural rubber	100,000	
Consumption* of natural rubber	91,427	
Consumption* of synthetic rubber	346,314	
TOTAL	537,741	
Deficit	6,616	1.2

* Consumption includes rubber consumed for export articles.

Total consumption exceeded supply by only 6,616 metric tons, or about 1%. Although 82.8% of Germany's needs came from synthetic rubber, the contribution of natural rubber was of especial strategic importance since it was necessary for certain critical tire parts. Though the stock withdrawal seems small, it is significant in view of the very low stocks at the start of the war. At the end of 1944 the estimated stockpile of natural and synthetic rubber was only 7,270 metric tons (5,200 tons Buna), or less than one month's supply for the industry before bombing. Reclaim consumption from September, 1939, to January, 1945, amounted to 238,841 tons and was apparently about equal to production, since stocks stayed at about the same level.

[8] Source: **Fachgruppe Kautschukindustrie.**
[9] Based on 40 pounds of rubber in a medium-size heavy-duty tire.

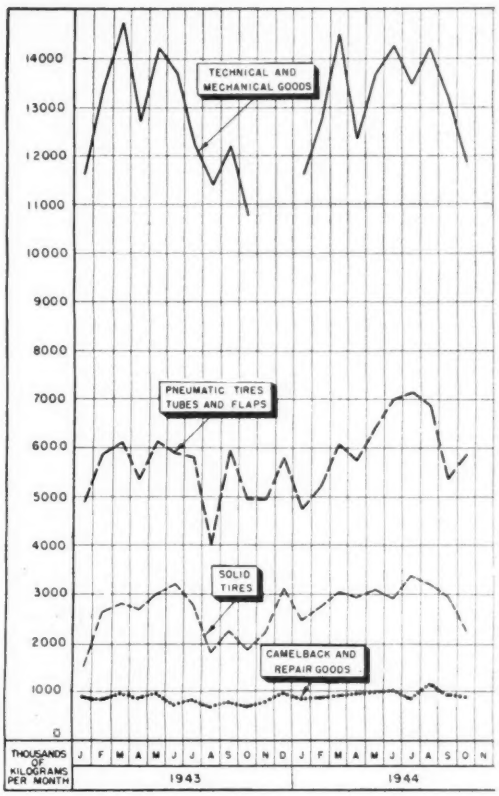


Fig. 5. Deliveries of German Rubber Industry by Principal Types of Products

Substantial quantities of rubber were lost at Ludwigshafen (784 tons) and Hüls (500 tons) in fires that raged for days. Equally serious losses occurred at Continental until the plant resorted to storing raw stocks underground. Loss of stocks of finished rubber goods during the retreat on the Russian front was reported to be enormous.

Distribution and Stocks of Processed Rubber

According to The Government Board for Rubber, processed rubber articles were distributed to the army and the civilian economy as outlined in Table 7. This table shows that the proportion of all fabricated articles going to the Armed Forces was increasing steadily throughout the war.

TABLE 7. DISTRIBUTION OF FINISHED PRODUCTS, EXCLUDING EXPORTS
(Based on Rubber Content)

Year	% Distributed to Army	% Distributed to Civilian Economy
1939	52.4	47.6
1940	60.5	39.5
1941	65	35
1942	61.4	38.6
1943	65.1	34.9
1944*	70.9	29.1

* Planned.

In the tire category, however, the Armed Forces received 75% of the production until the latter part of the war when the army's share had risen to 85%. Between January and December, 1944, total stocks of passenger tires decreased from 27,720 to 18,306; while truck and bus tire stocks dropped from 59,429 to 19,201, despite the fact that tire production increased until August of that year. The stock of these materials at the end of the year represented only a few days' requirements based on prebombing conditions. The army consumed increasing quantities of re-

placement tires to make up for destruction and wear as the Allies pushed their land offensives.

Rubber Quality

During the early part of the war sufficient natural rubber was available so that the Germans were not forced to make an all-synthetic rubber tire. In 1943, according to Dr. Weber, of Continental Rubber Co., they attempted the manufacture of 100% Buna S tires, but considerable difficulty resulted. There is some conflict in information obtained from the Germans as to subsequent developments, particularly those occurring near the end of the war. Some improvement in fabrication is reported to have been obtained in 1944 by the use of Buna S 3, a more adhesive and more workable type of Buna. In general it appears that the fabricators had the alternative for tire manufacture of either (1) using 14% natural rubber and 86% synthetic if natural rubber were available or (2) employing 100% synthetic with Koresin, a potent tackifier discovered by the Germans. Koresin was always in short supply, however, because of the bombing of the only producing unit at Ludwigshafen. Dr. Weber reports that tubes made of 100% synthetic rubber were tried, but performance was so poor that after the middle of 1944 it was decided to use 25% natural rubber.

Carbon Black Production and Consumption

According to the Germans, carbon black supplies were adequate for all rubber requirements during the war. The industry had a capacity rating of about 79,000 tons per annum before bombing.

Production, which exceeded consumption by a small margin over the years 1942-44, ran from 50,000 to 58,000 tons a year. Although some of the carbon black plants were out of action during the war as the result of bombing, the decrease in requirements as the result of bombing of the fabricating plants prevented a shortage. Undoubtedly black would have limited rubber consumption otherwise.

Attempt to Protect the Rubber Industry from Bombing

Although the decision to disperse and go underground in the oil industry had been taken in June, 1944, it was not until the beginning of 1945 that an underground Buna plant project was undertaken. A number of locations were selected, but were rejected in favor of a large concrete vault at Muehldorf. The synthetic rubber plant was to have a capacity of 1,000 tons a month, with the possibility of later expansion to 2,000 tons. It was to operate on acetaldehyde and ethyl benzene brought in from near-by plants. A tire factory to handle the rubber was also planned in this same vault. Construction was undertaken in March, 1945, but excavation was not complete, and no equipment had been installed when the vault was captured by the American Army.

Underground tire fabrication was attempted at Tharandt near Dresden. Several of the bombed rubber processing plants had dismantled equipment, but had been unable to move it from plants to the underground location because of transportation tie-ups. No information is available on the planned capacity of this plant.

Conclusions

When war ended in Europe, damage to the German rubber industry was insufficient to constitute a major factor in the Wehrmacht's defeat. The important damage that had been done was in large part an accidental dividend derived from the all-out oil offensive that began in May, 1944. While it is true that lack of gasoline alone stalled the German war machine so that attacks on rubber plants appeared to be unnecessary, there is considerable evidence that had synthetic oil, rubber, and chemicals been considered as a single target group, the same results could have been achieved more expeditiously. This evidence includes:

(1) Interviews with German government officials which revealed that they were in constant dread of an all-out attack on synthetic rubber, particularly after the successful bombing of Hüls. Knowledge of the vulnerability of these plants caused drastic conservation measures, culminating in an order limiting all traffic behind the front (military and civilian) to a maximum speed of 17 miles per hour.

(2) The highly successful results of the one attack on Hüls in June, 1943, caused a loss of 12,000 tons of Buna production and reduced stocks of both raw rubber and finished tires to one month's and 1.5 months' normal consumption, respectively. Nazi experts were amazed that such an attack was not repeated. They testified that similar attacks on Schkopau, Ludwigshafen, and Leverkusen could have paralyzed the rubber industry and left Germany rubberless in two to four months.

The August 5, 1944, report of the German Air Force Staff, Plans Division, states, "The destruction of Schkopau, together with one of the other three plants (Hüls, Ludwigshafen, Auschwitz) will cripple more than two thirds of the total Buna production and have a catastrophic effect on the rubber supply, vital to the armament industry."

(3) The fact that the attacks on synthetic oil plants, roundabout as they were in terms of direct planning against synthetic rubber, reduced Buna production from an average of 11,800 tons a month in the first four months of 1944 to 1,800 tons in December. Buna stocks dropped from 13,000 tons in January, 1944, to 5,000 tons at the beginning of 1945, and the government belatedly decided to put a synthetic rubber plant underground.

The drop in Buna production had an almost immediate effect on processing and finished stocks. Tire rubber consumption dropped from a normal level of 3,400 metric tons a month to 943 tons in February, 1945. During 1944 stocks of heavy-duty tires dropped from 59,400 in January to 19,200 in December, and production of airplane tires declined from 40,000 a month to 19,000.

That this much damage was done almost inadvertently (except for the one Hüls attack)—or at least with very sporadic bombing priorities directed against rubber production—indicates how much more could have been accomplished by a consciously coordinated attack. The fact remains that, at the war's end, while the air force had put the rubber industry on the rocks, the German war effort *had not been directly affected* by a shortage of rubber.

The conclusions suggested are:

(1) Synthetic rubber plants offered an effective target system, easily identified vulnerable, and slow to repair. Moreover the product of these plants was absolutely essential to modern warfare.

(2) The processing plants were not an ideal target system since they were numerous, dispersed, and relatively easy to repair. As such, they should not have been included on the target list, at least until after raw material plants had been taken care of.

(3) The air forces' target intelligence, while essentially correct in appraising the German rubber industry, erred in overlooking the inseparability as targets of rubber and other chemical plants and overestimated the stock cushion.

(4) The best way to insure that Allied air attacks inflicted the greatest harm to the over-all German war effort would have been to consider synthetic oil, chemical, and rubber targets as a group. Had the delicate interrelation between Buna and the other chemical products been defined and considered in operational plans from the beginning, it is felt that an even larger extra dividend would have resulted from the oil offensive in the form of a more complete stoppage of synthetic rubber production in time to have contributed directly to the collapse of Nazi Germany.

"The production of synthetic rubber, one of the most important branches of the chemical industry, is especially vulnerable to air attack. To date, production has been confined to three plants (Ludwigshafen-Oppau, Hüls, and Schkopau). A fourth plant, Auschwitz, is expected to begin operations in May. Over one half of the production

(Continued on page 720)

Non-Sulphur Vulcanization—II

An Experimental Study

Turner Alfrey,[1] J. G. Hendricks,[2] Robert M. Hershey,[3] and H. Mark[1]

IN THE previous paper[4] the literature on non-sulphur vulcanization was reviewed, with particular emphasis on the reaction mechanisms involved. In this paper is reported a series of experiments conducted in this laboratory. The first part of this paper deals with chemical investigation of dinitrobenzene vulcanization. The second part deals with the physical properties of non-sulphur vulcanizates and includes some results reported in the literature as well as those experimentally established here.

Chemical Investigation of Dinitrobenzene Vulcanization

Discussion of Results

Wright and Davies (1)[5] have shown that when rubber is vulcanized in solution with dinitrobenzene, either water or litharge and fatty acid (which form water) must be present for gelation to occur. Furthermore in order to make hard rubber with dinitrobenzene both water and litharge must be added to the dry rubber. No prior work has been carried out with fatty acid-free rubber in investigating nitrobenzene vulcanization of dry rubber in the soft rubber stages, but it has been generally assumed that the results of vulcanization in solution may be applied to "dry" rubber vulcanization. We have now investigated this point, obtaining results which are not in agreement with the above assumption. We find that fatty acid or water is not necessary for the vulcanization of "dry" rubber by nitrobenzene in the soft rubber stages.

The course of the vulcanization reaction was traced by following the change in unsaturation and the changes in physical properties of the rubber. Since direct addition of water to the rubber might lead to questionable results because of solubilities and temperatures encountered, it was considered best to control the amount of water present through the addition of litharge and fatty acid to extracted rubber.

TABLE 1. EFFECT OF FATTY ACID ON DINITROBENZENE VULCANIZATION

	1	2	3	4	5
Extracted pale crepe ..	100.00	100.00	100.00	100.00	100.00
m-Dinitrobenzene	6.00	6.00	6.00	6.00	4.00
Litharge	9.00	9.00	9.00	9.00	5.34
Stearic acid	....	5.65	8.47	11.3	5.80

Physical Properties

Sample	t/287° F. Min.	Tensile Strength in P.S.I.	% Elongation	M-300 P.S.I.	M-500 P.S.I.
1	15	1200	670	100	350
	20	1200	700	150	400
	30	1200	720	200	600
2	15	1300	740	125	300
	20	1800	720	150	400
	30	1200	610	200	500
	45	900	530	200	650
	60	900	540	225	800
3	15	1160	740	100	200
	20	1400	690	150	300
	30	1600	650	150	450
	45	2000	640	200	600
	60	1600	600	250	600
4	15	800	790	100	200
	20	800	710	150	300
	30	800	600	175	350
	45	1350	650	200	400
	60	1400	610	200	600
5	15	400	800	100	200
	20	500	730	100	200
	30	1200	750	100	250
	45	1250	770	150	300
	60	1200	700	175	400

Iodine Number

Time of cure at 287° F. ..	0	15	20	30	45	60
Extracted crepe	362	..	..	..	..	..
Sample 1	..	312	315	315	..	..
2	..	312	313	311	309	302
3	..	313	313	302	311	303
4	..	313	313	311	309	302
5	..	348	342	340	328	329

The careful and exhaustive extraction of rubber removed all but extremely minute traces of moisture and fatty acid. The rubber was then compounded and cured for various lengths of time at 287° F. The physical and chemical properties of the resulting vulcanizates are listed in Table 1. The column t/287° F. represents the curing time at 287°. The column M-300 and M-500 show the modulus at 300% and 500% elongation.

These data indicate that the amount or even the absence of fatty acid (or potential water) does not appreciably affect the physical characteristics or the rate and extent of change in unsaturation. In sharp contrast, if the amounts of dinitrobenzene and litharge are reduced, there is a definite decrease in the number of double bonds consumed during the reaction and in the rate of vulcanization as measured by physical properties. In each case, unsaturation drops rapidly and quite sharply in the initial stages of the reaction. There is a small, but definite, further decrease in unsaturation over the normal curing range. The magnitude of the original change in iodine number as well as the rate and extent of further changes in unsaturation in this region depends upon the concentrations of litharge and dinitrobenzene employed.

Experimental Procedure

The large-scale extractions were run in a two-liter glass Soxhlet extractor. About 100 grams of pale crepe were sheeted very thin and wrapped around wire. The wire was then rolled loosely and placed in the extractor. C. P. acetone (BP 58-59° C.) was used as the solvent. The solvent was evaporated from a two-liter flask, condensed, and led into a vertical cylinder about 15 inches in height, which contained the sample. When the liquid level in the cylinder reaches the height of the side arm, the solvent and extract flow into the two-liter flask. After one-day extraction the solvent in the cylinder was usually clear. At an appropriate time during the distillation on the first or second day the residual material in the two-liter flask was removed and fresh acetone added and the extraction continued for 8-10 days. Following extraction the samples were immediately placed in a dessicator under carbon dioxide. Any remaining acetone was removed by using warm mill rolls when mixing the extracted samples to insure uniformity.

In general, A.S.T.M. compounding procedures were followed. The compounding ingredients were of high purity and of such a particle size as to permit passage through a 300-mesh screen. Prior to addition of the reagents the mill rolls were warmed by use of hot water to a temperature of 130°-140° F. to bring about evaporation of any residual acetone in the rubber.

Unsaturation determinations were made essentially by Blake's (2) procedure, which is a modification of that of Kemp(3).

Physical Properties of Non-Sulphur Vulcanizates

It is impossible to gain a clear picture of the physical properties which can be obtained by the use of non-sulphur vulcanizing agents unless the conditions of vulcanization (including the use of modifying agents) are varied widely and are carefully specified for each experiment. This point is also true of sulphur vulcanization. The simple sulphur vulcanizates have physical characteristics quite inferior to those of a modern formulation, which may contain highly

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[4] INDIA RUBBER WORLD, Aug., 1945, p. 577.
[5] Bibliography references appear at end of article.

TABLE 2. QUINONE DERIVATIVES IN NATURAL RUBBER

Sample		t/287° F. Min.	Tensile Strength P.S.I.	% Elongation	M-300 P.S.I.	M-500 P.S.I.	Shore Hardness
C-1		15	20	300	....	....	17
Pale crepe	100	30	20	400	....	....	17
Quinone	10	60	20	500	....	....	17
Red lead	10	90	20	500	....	....	17
		120	20	500	....	....	17
C-2		15	200	820	....	....	23
Pale crepe	100	30	200	830	....	....	21
Chloranil	5	60	500	880	....	....	20
		90	540	870	....	....	20
		120	400	900	....	....	19
C-3		15	1185	550	210	900	....
Pale crepe	100	30	1320	500	300	1320	....
Chloranil	5	60	1000	480	310	....	....
Lead dioxide	10	90	1820	550	300	1110	....
		120	1380	490	300	....	....
C-5		5	1460	410	630	....	47
Pale crepe	100	10	2100	410	1100	....	53
Chloranil	5	15	1850	350	1430	....	56
Lead dioxide	10	20	2500	320	1800	....	56
E. P. channel black	40	45	1900	300	1900	....	59
		90	1600	270	....	....	60
C-5a		15	810	250	....	....	50
Pale crepe	100	20	1690	350	1220	....	50
G M F (commercial p-quinone dioxime)	2	30	2280	420	1230	....	50
Red lead	20	45	1970	380	1300	....	50
E. P. channel black	40	60	2390	410	1220	....	50
		90	2390	430	1220	....	50

TABLE 3. EFFECT OF CHLORANIL CONCENTRATION IN GR-S

Sample		t/287° F. Min.	Tensile Strength P.S.I.	% Elongation	M-300 P.S.I.	M-500 P.S.I.	Shore Hardness
C-9							
GR-S	100.0	5	750	770	100	300	43
E. P. channel black	40.0	10	1300	750	200	500	47
Chloranil	2.0	15	1400	730	200	600	50
Litharge	10.0	20	1350	600	300	900	52
C-10							
GR-S	100.0	5	1625	6500	300	1000	50
E. P. channel black	40.0	10	1650	500	600	1600	57
Chloranil	4.0	15	1650	470	700	....	57
Litharge	10.0	20	1150	330	850	....	60
C-11							
GR-S	100.0	5	1600	510	600	1450	53
E. P. channel black	40.0	10	1500	390	900	....	60
Chloranil	6.0	15	1100	300	1100	....	62
Litharge	10.0	20	900	260	....	....	62
C-12							
GR-S	100.0	5	1700	540	650	....	56
E. P. channel black	40.0	10	2150	340	....	....	60
Chloranil	8.0	15	1050	250	....	....	62
Litharge	10.0	20	1000	230	....	....	65
C-13							
GR-S	100.0	5	1650	460	....	....	58
E. P. channel black	40.0	10	1150	250	....	....	62
Chloranil	11.0	15	1000	220	....	....	63
Litharge	10.0	20	850	230	....	....	63

developed sulphur accelerators, activators, reenforcing pigments, and antioxidants. It would therefore be misleading to compare the properties of a simple non-sulphur vulcanizate, in which no modifying agent or a casually chosen agent is used, with those of a modern sulphur vulcanizate which has been developed after many years of painstaking research.

In general the non-sulphur vulcanizing agents impart a faster curing rate than does sulphur. The tensile strengths of most non-sulphur vulcanizates are slightly—sometimes appreciably—lower than those of sulphur vulcanizates. Non-sulphur vulcanizing agents, however, are known which may impart a tensile strength up to 15 times greater than that obtainable with sulphur, e.g., the action of Durite S2666 in Hycar OR non-black stocks. In most cases, particularly with synthetic rubbers, the aging characteristics of non-sulphur vulcanizates are outstanding. A few of the simple non-sulphur agents, e.g., benzoyl peroxide, impart poor aging characteristics, but this may be rectified by choice of a suitable antioxidant (4).

The characteristics of non-sulphur vulcanizates can best be judged individually. Many of these vulcanizates can be and are worthy of being developed to a much greater degree. In the sections that follow the physical properties of typical non-sulphur vulcanizates are shown. Data for the simple vulcanizate are shown in each case. In addition to these the effect of modifying agents is described whenever their action is known. Pertinent physical data from the literature are included wherever this action seems desirable.

Quinone Derivatives

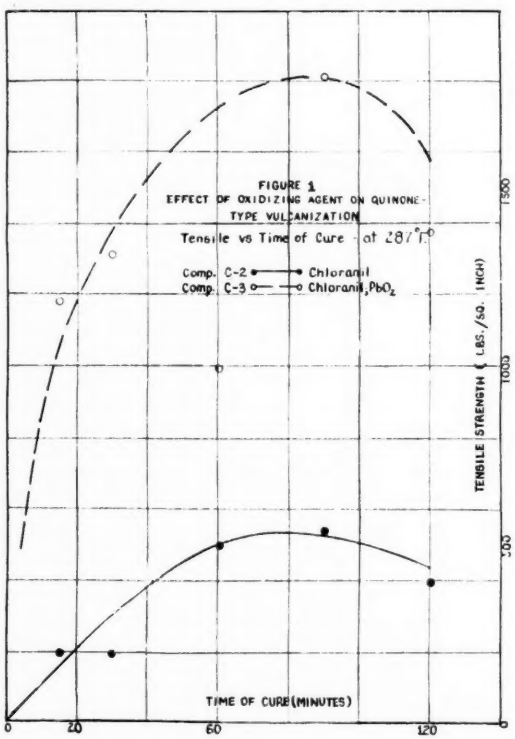
Benzoquinone itself is not a good vulcanizing agent, although its use has been patented (5). Many quinone derivatives, such as chlorinated quinones and quinone oximes, however, are excellent vulcanizing agents for both natural and synthetic rubbers. Oxidizing agents are not strictly required for quinones. The use of oxidizing agents, however, always greatly improves the physical properties. If hydroquinones or other reduced forms are used, then an oxidizing agent is required. Some oxidizing agents are better than others for a specific vulcanizing agent, and Fisher has indicated this to some extent, particularly in his patents (6-9).

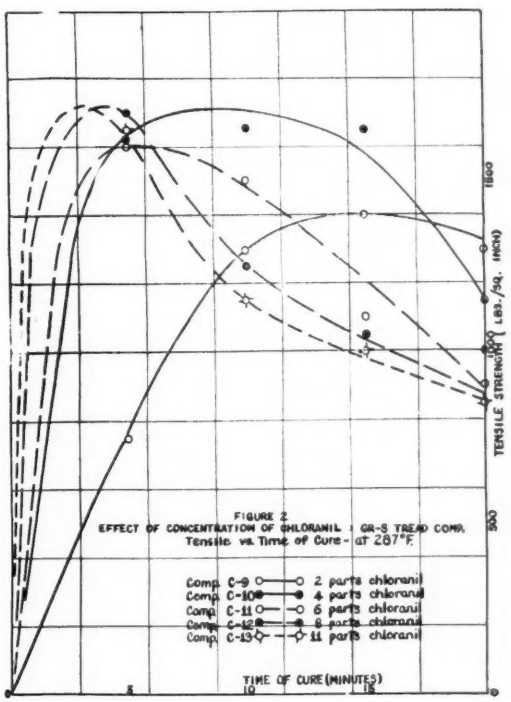
Table 2 shows results obtained with quinone derivatives in natural rubber. In Figure 1 are plotted the tensile strength *vs.* time of cure curves for two gum stocks containing chloranil. The improvement effected by the use of oxidizing agent is clearly shown.

The action of chloranil on GR-S was also studied. Litharge and channel black were added in all cases, and the con-

TABLE 4. VULCANIZATION OF BUTYL RUBBER

Sample		Vulcanized at 307° F. t/307° F. Min.	Tensile Strength P.S.I.	% Elongation	M-300 P.S.I.	M-500 P.S.I.	Shore Hardness
C-14							
GR-I	100.0						
E. P. channel Black	60.0						
Zinc oxide	5.0	15	no cure	.....	.....	.....	.....
Stearic acid	3.0	30	2460	860	240	.....	.....
Tetramethylthiuram-disulphide	1.0	60	2520	780	440	.....	.....
Mercaptobenzothiazole	0.5						
Sulphur	2.0						
		Vulcanized at 287° F.					
C-15							
GR-I	100.0	5	1900	650	600	1400	62
E. P. channel black	60.0	10	1900	625	650	1500	62
Zinc oxide	5.0	15	1900	600	700	1650	63
Stearic acid	3.0	20	1900	580	750	1650	63
Red lead	10.0	30	1900	580	750	1650	63
G M F (commercial p-quinone dioxime)	2.0	40	1900	570	750	1650	63
C-16							
GR-I	100.0	10	1700	530	800	1600	73
E. P. channel black	60.0	20	1600	500	800	1600	73
Zinc oxide	5.0	30	1600	500	800	1600	73
Stearic acid	3.0	40	1600	500	800	1600	73
Red lead	10.0	60	1600	510	750	1600	73
Dibenzo G M F (commercial dibenzoate of p-quinone dioxime)	6.0	80	1550	530	750	1400	73





centration of chloranil was varied. The results are shown in Table 3 and Figure 2.

Some quinone derivatives are powerful vulcanizing agents and may bring about the vulcanization of natural rubber at room temperature. This activity may be utilized to particular advantage with some of the slow curing synthetics. Quinone derivatives are among the most practical of the non-sulphur agents, and current application is found in the vulcanization of Butyl rubber (10-11) in the manufacture of tire tubes. The following experiments (Table 4 and Figure 3) illustrate the rapid cures and high moduli obtainable with quinone derivatives in the case of Butyl rubber.

Nitrobenzenes

Polynitrobenzenes impart properties to rubber that may be utilized commercially. The physical properties of the best nitrobenzene vulcanizates compare very favorably with the best obtainable by sulphur vulcanization of either natural rubber or GR-S (12).

The vulcanizing action of nitro compounds is directly related to the degree of nitration of the benzene nucleus. Trinitrobenzene is the most powerful of these reagents and is said (13) to be capable of vulcanizing rubber without the aid of oxidizing agents. Mononitrobenzene is a very weak vulcanizing agent. m-Dinitrobenzene is commonly used as it appears to have the best general characteristics. In GR-S, m-dinitrobenzene has been reported to be an excellent vulcanizing agent, with particularly good aging characteristics. Litharge, which apears to be specific (12), is used as an oxidizing agent.

Conflicting data found in the early literature regarding the physical properties of nitro vulcanizates seems to be due to the use of excess quantities of the reagent or to unfortunate compounding practices (13, 14). Ostromislensky (13), in a detailed study of trinitrobenzene vulcanization, lists nine advantages of trinitrobenzene over sulphur as a vulcanizing agent. The use of certain aromatic amines (0.3-1.0%) is recommended to protect the nitro vulcanizates from oxidation. Table 5 and Figure 4 show typical characteristics of trinitrobenzene and m-dinitrobenzene vulcanizates, in both natural rubber and GR-S.

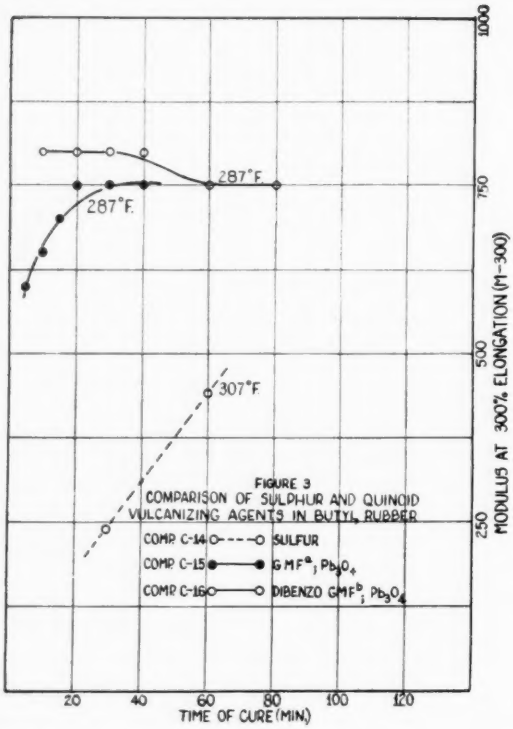


FIGURE 3
COMPARISON OF SULPHUR AND QUINOID VULCANIZING AGENTS IN BUTYL RUBBER

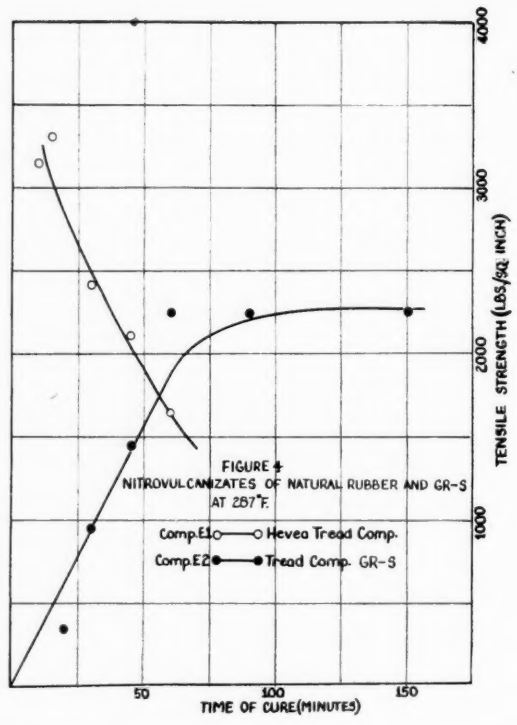


FIGURE 4
NITROVULCANIZATES OF NATURAL RUBBER AND GR-S AT 287°F.

Benzoyl Peroxide

Benzoyl peroxide does not appear to have potential application as a vulcanizing agent for rubbers although its use has been advocated for rubber-like polyesters (15-17). There are, nevertheless, definite procedures and techniques which improve peroxide vulcanization.

In mixing the batches care must be taken to keep the mill rolls cool to prevent thermal decomposition of the agent (4). In some cases it may be necessary to sift the reagent before addition to the batch or otherwise insure proper particle size. Approximately 10% of the peroxide appears to give best results. The compounds should be cured within a relatively short period after milling. If this is not done, a combination of autooxidation and premature vulcanization often appears to take place. At 141° C. (287° F.) the optimum cure is reached in a short time. Overcuring seems to have little effect on physical properties.

Unless other materials are used with benzoyl peroxide, the vulcanizates have poor heat resistance and aging properties. Mixtures containing sulphur (0.2-1.0%) greatly improve aging (14). Initial sulphur consumption is high, but is greatly retarded in a short time, probably owing to the formation of benzoic acid (4). [It has been claimed that when sulphur and benzoyl peroxide are used together, vulcanization takes place exclusively by the peroxide (14)]. Perhaps the greatest improvement in agent may be obtained by the use of certain of the usual antioxidants. The poor aging qualities of the simple vulcanizates, and the improvement imparted by antioxidants, are shown in Table 6 (4).

The effect of a few of the sulphur accelerators has been investigated and found to be ineffective or to act as retarders of peroxide vulcanization (4). Metal oxides are not required (18), and their presence accelerates deterioration of the vulcanizate (14).

All peroxide cures "bloom," e.g., a substance (benzoic acid) crystallizes on the surface of the vulcanizate. The gum stocks are transparent. Vulcanizates are usually soft and occasionally somewhat porous.

Peroxide vulcanization may be used for synthetics as well as natural rubber, but in no cases are outstanding physical properties observed. Typical results are shown in Tables 7 and 8.

TABLE 5. TYPICAL NITRO VULCANIZATES OF NATURAL RUBBER AND GR-S

Sample		t/287° F. Min.	Tensile Strength P.S.I.	% Elongation	M-300 P.S.I.
LE-4*					
Pale crepe	100.0	25	3665	780	....
1, 3, 5, trinitrobenzene	2.0	30	3520	760	....
Aniline	1.0	35	3450	760	....
Zinc oxide	150.0	40	3600	760	....
E-1					
Pale crepe	100.0	10	3140	530	1210
E. P. channel black	40.0	15	3300	480	1600
m-Dinitrobenzene	5.0	30	2410	366	1910
Litharge	10.0	45	2100	300	2100
		60	1620	230	....
E-2					
GR-S	100.0	20	350	1220	....
E. P. channel black	40.0	30	950	1050	200
m-Dinitrobenzene	3.0	45	1450	880	250
Litharge	5.0	60	2250	790	350
		90	2250	700	500
		150	2250	580	750

* Refer to bibliography item (13).

TABLE 6. AGING PROPERTIES OF PEROXIDE VULCANIZATION*

	LA-6	LA-7
First latex pale crepe	100	100
Benzoyl peroxide	11.1	11.1
AgeRite	....	1.0

Sample	t/147° F. Min.	Tensile Strength P.S.I.	% Elongation	Shore Hardness
LA-6	20	680	700	30
Aged 1day 70° C.	20	155	440	25
Aged 2 days 70° C.	20	115	378	25
Aged 4 days 70° C.	20	130	413	25
LA-7	20	600	840	30
Aged 1 day 70° C.	20	640	850	30
Aged 3 days 70° C.	20	510	785	29
Aged 7 days 70° C.	20	525	795	28
Aged 14 days 70° C.	20	430	761	25

*Refer to bibliography item (4).

Diazoaminobenzenes

Diazoamino compounds give vulcanizates that are clear and transparent and often age well (19). 2,4,6,2',4',6'-hexachlorodiazoaminobenzene, for example, gives excellent products which are transparent like molded pale crepe. N-benzyldiazoaminobenzene is said not only to be an excellent vulcanizing agent, but to impart excellent aging char-

TABLE 7. EFFECT OF TEMPERATURE ON PEROXIDE VULCANIZATION*

Sample LA-5

First latex crepe	100.0
Benzoyl peroxide	11.1

Time Min.	Tensile Strength P.S.I.	% Elongation	M-700 P.S.I.	Shore Hardness
		Vulcanization at 297° F.		
10	615	740	470	38
20	780	750	500	39
30	715	760	450	40
60	640	740	500	41
120	715	760	450	41
		Vulcanization at 194° F.		
30	200	1030	50	21
60	150	980	100	26
120	530	990	100	28
210	530	950	125	30

*Refer to bibliography item (4).

TABLE 8. PEROXIDE VULCANIZATION OF SYNTHETIC RUBBERS

Sample		t/287° F. Min.	Tensile Strength P.S.I.	% Elongation	M-300 P.S.I.	Shore Hardness
A-3		15	Stuck to mold	..	..	..
Buna S	100.0	30	80	500	60	38
E. P. channel black	40.0	60	90	470	60	38
Benzoyl peroxide	5.0	90	90	430	80	38
		120	110	450	90	38
A-4		15	900	480	600	68
Hycar OR-15	100.0	30	1050	400	650	68
E. P. channel black	50.0	60	1400	420	1000	68
Benzoyl peroxide	5.0	90	1600	420	1100	68

TABLE 9. TYPICAL DIAZOAMINO VULCANIZATION PRODUCTS

Sample		t/287° F. Min.	Tensile Strength P.S.I.	% Elongation	M-300 P.S.I.	M-500 P.S.I.	Shore Hardness
B-1		15	1000	640	100	300	36
Extracted pale crepe	100.0	20	1000	640	100	300	37
Diazoamino-benzene	7.0	30	1100	620	100	300	37
B-2		30	590	580	..	400	30
Pale crepe	100.0	60	1320	720	..	310	30
Diazoamino-benzene	5.0	90	1210	710	..	380	29
Lead chromate	40.0	120	1200	680	..	380	29
B-3		15	800	420	500	..	48
GR-S	100.0	30	750	360	600	..	52
E. P. channel black	40.0	60	1100	430	650	..	53
Diazoamino-benzene	4.0	90	1250	390	750	..	54
Lead chromate	40.0	120	1250	400	750	..	55

acteristics as well. Fisher states that these agents do not require the presence of any other substance, but, as one of his patents (6) indicates, the properties of the vulcanization are considerably improved by the use of an oxidizing agent.[7]

Diazoamino compounds may be used to vulcanize both natural and synthetic rubbers, as shown in Table 9.

Amines and Phenols

Amines and phenols do not seem to be among the practical non-sulphur vulcanizing agents. Tensile strengths obtained are generally low. An oxidizing agent is required in this type of vulcanization. Table 10 illustrates some of the properties of rubber and GR-S vulcanizates obtained with various amines and phenols. It is clear that these amines and phenols are not very effective vulcanizing agents.

Durite S-2666 (20)

One of the most interesting of all non-sulphur vulcanizing agents is Durite S-2666.[8] This material, a polymer of undisclosed composition, is an excellent vulcanizing agent for Hycar OS-20 and Hycar OR-15 (modified commercial

[7] We are indebted to E. Krissman, of E. I. du Pont de Nemours & Co., Inc., for suggesting that when the proper oxidant is used, diazoaminobenzene vulcanization probably proceeds to a large extent through the mechanism suggested for the dinitro aryl compounds.

[8] Unfortunately this material is somewhat toxic.

TABLE 10. PHENOLS AND AMINES AS VULCANIZING AGENTS

Sample		t/287° F. Min.	Tensile Strength P.S.I.	% Elongation
LD-1*				
Natural rubber	100.0	30	110	1100
o-Amino phenol	10.0	90	190	830
Manganese dioxide	20.0	150	240	790
LD-2*				
Natural rubber	100.0	30	930	760
Manganese dioxide	30.0	90	930	570
Aniline	7.5	150	930	560
LD-3*				
Natural rubber	100.0			
Manganese dioxide	20.0	90	1020	800
p-Hydroxy diphenyl amine	7.5	150	1825	710

Sample		t/287° F. Min.	Tensile Strength P.S.I.	% Elong.	Shore Hardness
D-1					
Pale crepe	100.0	15	20	800	10
Phenol	10.0	30	20	800	15
Red lead	10.0	60	20	800	18
		90	20	800	18
		120	20	800	18
D-2					
Pale crepe	100.0	2, 4, and 6½ hours at 287° F. gave a definite cure, but the samples were porous and somewhat tacky.			
Aniline	10.0				
Lead Dioxide	5.0				
D-3					
Pale crepe	100.0	20, 30, 240, and 390 minutes at 287° F. gave a definite cure, but the samples were porous and somewhat tacky.			
Phenol	10.0				
Lead dioxide	5.0				
D-4					
Pale crepe	100.0	15	20	100	12
Diphenylamine	10.0	30	20	100	12
Read lead	20.0	60	20	100	15
		90	20	100	15
		120	20	100	15
D-5					
GR-S	100.0	15	60	300	33
E. P. channel black	40.0	30	115	1000	46
Phenol	5.0	60	280	960	46
Red lead	20.0	90	290	850	48
		120	350	910	48
D-6					
GR-S	100.0	15	40	100	30
E. P. channel black	40.0	30	40	100	32
Aniline	5.0	60	40	100	35
Red lead	20.0	90	40	100	35
		120	40	100	35
D-7					
GR-S	100.0	15	10	350	30
E. P. channel black	40.0	30	10	350	32
Diphenylamine	10.0	60	20	450	33
Red lead	20.0	90	20	600	35
		120	20	600	37

*Refer to bibliography item (6).

copolymers of butadiene-styrene and acrylonitrile, respectively). The physical characteristics of these vulcanizates are outstanding. Durite S-2666 imparts a tensile strength of up to 5000 p.s.i. to these copolymers, even in the absence of carbon black. Sulphur vulcanizates of corresponding (non-black) composition have a tensile strength of about 300 p.s.i.

Since the composition of Durite S-2666 has not been disclosed, it is impossible to make a complete examination of its action during the vulcanization process. The supplier of this material attributes the high tensile strength imparted by Durite S-2666 to the formation of long-chain cross-linkages between the rubber molecules. In such a case the long-chain cross-linkages would allow greater interaction of the intermolecular forces and a greater degree of orientation which could result in greater strength.

Durite S-2666 does not require the presence of double bonds in the rubber to bring about vulcanization. It is capable of vulcanizing polyisobutylene, polyvinylacetate, and other materials. The presence of a simple double bond in a rubber, on the other hand, is insufficient to bring about vulcanization in the presence of the Durite agent. The Durite S-2666 will not vulcanize natural rubber, extracted natural rubber, or GR-S.

Summary of Physical Properties

The wide variations in effectiveness of different non sulphur-vulcanizing agents are brought out in Figures 5 to 7. Figure 5 shows the tensile strength *versus* time of cure for natural rubber gum stocks using different agents. Figure 6 shows a similar comparison for natural rubber tread

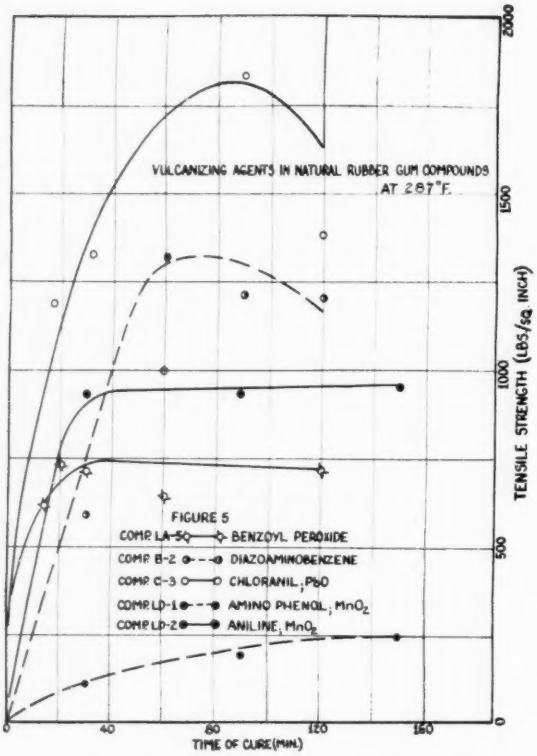
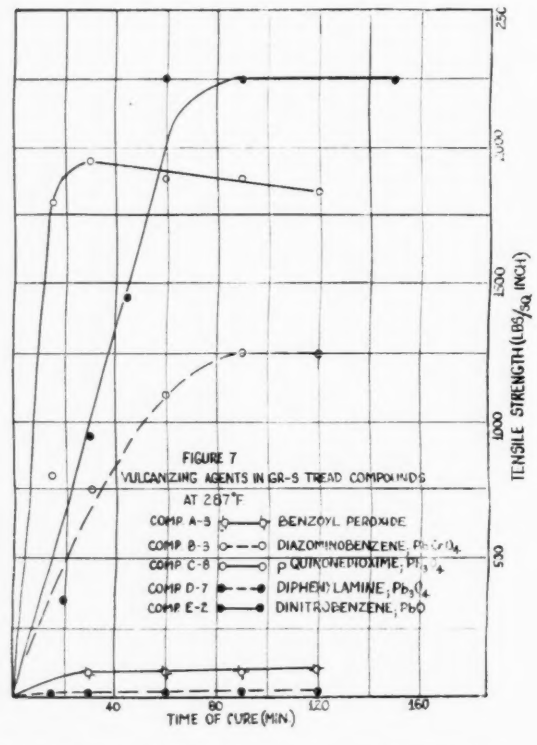


FIGURE 5



compounds, and Figure 7 for GR-S tread compounds.

A number of these compounds have remarkably good properties as vulcanizing agents, particularly in view of the fact that optimum vulcanization conditions (temperatures, modifying agents, etc.) were almost certainly far from reached. The outstanding characteristics imparted by the new type of organic vulcanizing agent, Durite S-2666,

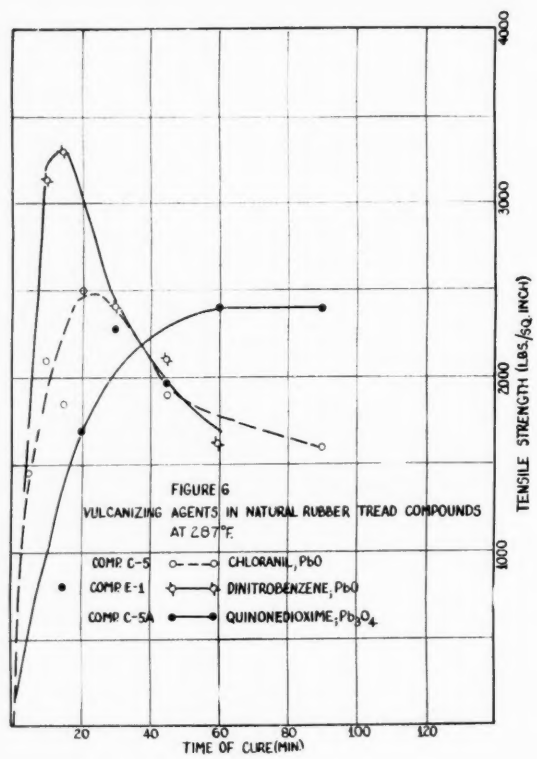


FIGURE 6
VULCANIZING AGENTS IN NATURAL RUBBER TREAD COMPOUNDS AT 287°F.

is indicative of the possibilities that lie in this relatively unexplored field.

It is a pleasure to acknowledge and thank H. L. Fisher, G. S. Whitby, J. T. Blake, A. V. Tobolsky, C. K. Novotny, and E. A. Hauser for discussion and constructive criticism of the original manuscript.

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Moisture Relations of Tire Cords in Tires[1]

Helmut Wakeham,[2] Edith Honold,[2] and H. J. Portas[2]

THE moisture content of a textile fabric has considerable influence upon its physical properties and upon its chemical degradation at elevated temperatures. Cotton cords, for example, generally increase in breaking strength with an increase in moisture content; whereas rayon shows a decrease in strength with increase in moisture. Other properties, such as elongation and similar elastic behavior, are likewise affected. These facts indicate that a thorough knowledge of the moisture contents in tires is essential in setting up test procedures and in studying the performance of cords in tires.

Opinions concerning the moisture contents of cords in tires were found to be so divergent that an experimental study of this factor using actual tires seemed desirable. Previous investigations on the moisture relations of textiles and rubber and on the rates of moisture diffusion in rubber indicate that the moisture contents of cords in the tire will depend somewhat on external conditions as well as upon the conditions within the tire during service. These researches leave unanswered, however, questions concerning the moisture gained or lost by the cords during certain manufacturing operations, such as in the vulcanization of the tire, during storage, or during service. In the present work temperature, humidity, and time, the most important determinants of moisture in the tire, were investigated to gain some information concerning the effect of these parameters on the moisture contents in tires under various conditions.

Data available in the literature lead to the conclusion that moisture transpires through the outer layers of rubber on a tire with relative ease. Edwards and Pickering[3] reported that the relative permeability of rubber to water vapor is approximately 50 times that to hydrogen, that the permeability is proportional to the partial vapor pressure of the water, and that the amount of vapor passed varies inversely with the thickness of the rubber. These findings were extended by later investigators[4] who showed that the passage of moisture through rubber is greater than that predicted by the simple diffusion laws because of the concomitant sorption process which takes place. The rate of passage or approach to equilibrium increases with temperature so that at high temperatures the cord in a tire would be expected to come to moisture equilibrium in less time than at some lower temperature. Doty, Aiken, and Mark[5] found that for substances, such as rubber, which contain hydrophilic material the permeability to water vapor is dependent upon the thickness of the layer. This factor would be of some importance in considering the moisture transmission in the heavier truck and bus tires.

Lyons and coworkers[6] carried out experiments on the moisture sorption at room temperatures of tire cords vulcanized in thin slabs of GR-S. These slabs were put through a cycle of exposure to humid and arid atmospheres while the weights of the slabs and the regains of the cords were followed. The rayon and cotton cords both increased in moisture content at a rapid though decreasing rate for the first 20 to 50 days during the humid portion of the cycle. After about 70 days the rate of moisture increase was approximately constant up to about 200 days. The results indicated that although rayon fabric in rubber picks up a larger amount of moisture than cotton cords (15% as compared to 5% for cotton), under dry conditions it loses this moisture more rapidly than cotton. Both types of cord exhibited some inertia with respect to moisture sorption or desorption. When a slab containing cotton cords was cut so that the cord ends were exposed directly to moisture vapor, the rate of moisture exchange increased markedly.

The foregoing information predicts in a general way the trends of moisture exchange between the cord in the tire and the outer atmosphere, but does not permit accurate evaluation of tire cord moisture contents because of the complexity of tire construction and indeterminant factors connected with tire manufacturing procedure. Actual moisture contents of cords in tires must be measured if information of this type is desired.

Procedure and Calculations

The problem of determining moisture contents of cords in tires was, in brief, one of removing the cord from its rubber sheath in the tire and placing it into a weighing bottle without permitting appreciable moisture exchange with the surrounding atmosphere. The conditions of transfer were found as follows. A rough estimate of the moisture content of the cord was made from known conditions of tire manufacture and from the recent history of the tire. Atmospheric conditions which would minimize moisture exchange were then chosen, using as a guide the data of Wiegerink[7] on moisture relations of textile fabrics, along with exploratory determinations of the weight changes observed with the exposure of freshly stripped cords from the tire. These conditions were then approached as nearly as practicable in a special temperature- and humidity-controlled room in which the cords were pulled from the tire.

The cords actually measured for moisture content were taken from an area inside a large tire section to reduce any short-time moisture interchange through the exposed ends of the cords. The samples were in the form of ½-inch strips consisting of rubber on one side and exposed cord on the other. For the first ply (the ply next to the inner tube) these strips contained tire rubber that separated the cord from the inner tube, together with cords from the first ply, but did not include rubber found between the first and second plies. Each sample was pulled off and dropped into a tared weighing bottle with one quick motion in order to minimize the exposure of the bared cords to the room temperature. The bottle was immediately covered and weighed. Calculation showed that the amount of moisture exchanged between the cord and the air in the weighing bottle was negligible.

The second and third plies were next pulled off in the sample area, leaving the fourth ply covered with a thin layer of rubber. The ends of ply four were cut loose, seized with a pair of pliers, and the cords with adhering rubber pulled out in strips and placed into the weighing bottle as before. Samples from the seventh layer were obtained in a similar manner. With each ply the cords were kept covered with a layer of rubber until the instant the sample was stripped out and placed into the bottle.

The weight loss in drying the cord plus adhering rubber in an oven at 105° C. was determined in the conventional A.S.T.M. manner[8] with P_2O_5 as the desiccant. The sample was then exposed to room air over night, and the rubber carefully picked off the cords. The dry weight of the cords alone was determined as before. Small strips of the ply rubber were also removed at the time of stripping from the

[1] Presented before Regional Meeting of American Chemical Society, Baton Rouge, La., Oct. 26-27, 1945.

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tire and placed into weighing bottles. These were weighed and heated in the same manner as described for the original sample to obtain the weight lost by the rubber in the oven drying process. These weight losses were used as indicated below.

The moisture contents,[9] in per cent of dry weight of cord, were calculated for the original cords as shown in Table 1. Triplicate determinations were made on each ply tested. The agreement obtained between individual samples from each ply is indicated in the results shown in Table 2. In all other results the values shown are the average of three determinations.

TABLE 1. SAMPLE CALCULATION OF MOISTURE CONTENT IN PER CENT. OF DRY WEIGHT OF CORD TAKEN FROM TIRE SECTION

		Grams
(1)	Weight of cord plus rubber as removed from tire	1.2942
(2)	Oven-dried weight of cord plus rubber	1.2740
(3)	Weight loss of cord and rubber in drying	0.0202
(4)	Weight of rubber sample as removed from tire	0.8615
(5)	Oven-dried weight of rubber	0.8604
(6)	Weight loss of rubber in oven drying	0.0011
(7)	Per cent. loss of rubber (based on original weight)	0.13%
	Average of three determinations	0.14%
(8)	Oven-dried weight of cord alone	0.4333
(9)	Oven-dried weight of rubber portion of sample (2)-(8)	0.8467
(10)	Loss in weight contributed by rubber in oven-drying of cord plus rubber $\frac{(9)}{100\% - (7)}$	0.0012
(11)	Loss in weight in cord alone (3)-(10)	0.0190
(12)	Moisture in cord (per cent. of dry weight) $\frac{(11)}{(8)} \times 100$	4.39%

TABLE 2. MOISTURE CONTENTS OF COTTON CORDS IN TIRES STORED FOR NINE MONTHS

(Temperatures, 80 to 100° F.; Relative Humidities, 45 to 60%)

Tire	Ply	Sample 1 (%)	Sample 2 (%)	Sample 3 (%)	Average (%)
A (new)	Third	4.39	4.46	4.50	4.45
B (run for 18,000 miles)	Third	4.45	4.49	4.50	4.48
	Fifth	4.56	4.56	4.61	4.58

Test Results

Effect of Storage on Moisture in the Cords

Measurements were made on two cotton tires in a preliminary experiment to determine the effect of prolonged storage on the moisture contents of the cords. These tires had been made as experimental tires with a special cotton fabric under similar manufacturing conditions, of identical S-4 rubber compositions, and, in fact, by the same tire builder. They were of 7.50-20 size with non-directional military tread, eight body plies, and two cap plies. One tire (B) had been tested on the U. S. Army Ordnance Tire Test Fleet course at San Antonio, Tex.[10] The test was run during the summer months, when the maximum day temperature was between 85 and 105° F.; wet road conditions were encountered approximately one-fourth of the time. Under these conditions tire (B) ran 18,000 miles before failure. The other tire (A) was maintained in its new condition except for the fact that it had been plunger-tested. Both tires were stored under identical conditions, ranging from 80 to 100° F. and from 45 to 60% relative humidity, for a period of approximately nine months before the moisture determinations were made. The results are tabulated in Table 2.

These results are subject to some error due to a small indeterminate amount of rubber still remaining on the cord after separation. If, for example, 5% of the weight of the dry cord is rubber, then the moisture content as calculated would be larger by about 0.1%.

The moisture contents obtained by this method were checked for ply three of Tire B by a second, but possibly somewhat less accurate method of removing the cord alone from the tire and determining its moisture content directly. In this procedure the cord before being placed into the weighing bottle was first carefully separated from the rubber in the conditioned room. It was found that about 12 minutes were required to make this separation. From data obtained by following the weight loss of newly exposed cords it was found that owing to the choice of room conditions the cord lost an average of 0.6% of its dry weight during its 12-minute exposure. When this value was added to the average value of 3.63% found for the exposed cord, a total of 4.2% was obtained for the moisture content of the original cord. This agrees reasonably well with the results reported in Table 2.

Although the two tires here compared were produced by identical manufacturing processes and conditions, and therefore probably had similar moisture contents at the start, their contrastingly different service histories would lead to the expectation that their moisture contents would be considerably different. The data in Table 2, however, show them to have almost exactly the same moisture contents in the cords when the measurements were made. In view of the literature evidence relating to the transfer of water vapor through rubber, it seems reasonable to assume that the cotton cords in these tires had reached a moisture equilibrium characteristic of the nine-month storage conditions and that their individual histories had not appreciably affected their moisture sorption characteristics.



Fig. 1. Tires Used in Tests for Exposure to Various Temperatures and Humidities. (For Complete Specifications and Histories of These Tires See Text)

Effect of Exposure to Various Temperatures and Humidities

The experiment described below was set up to give some indication of the range of moisture contents possible to the cords in tires and of the rate of approach to equilibrium under various conditions. Four tires were used, two with cotton and two with rayon fabric, all from the same manufacturer. There follows a summary of the history of each tire.

TIRE C. Size, 7.00-20, S-4, highway tread, rayon fabric, 10 plies. This tire was run for a short time on the Government Tire Test Fleet highway course at San Antonio, Tex., but was removed because of a manufacturing defect. Its tread wear was almost negligible, and the tire was used in lieu of a new rayon tire for this test. Mileage—1,399 miles.

TIRE D. Same specifications as Tire C. These two tires were mates from the same test set. This tire had been run on the Government Tire Test Fleet course until the tread was worn through to the breakers. Mileage—43,246 miles.

TIRE E. Size, 7:50-20, S-4, mud and snow non-directional tread, cotton fabric, eight body plies, two cap plies. This tire had been used for plunger tests, but was otherwise new and undamaged. Sections used for moisture determinations were taken from areas between the plunger tests.

TIRE F. Same specifications as Tire E. These two tires were mates from the same set. This tire had been run on the U.S.A.O. Tire Test Fleet course which included 15% cross-country trails. Mileage—16,275 miles.

These tires were received at different times over a two-month period prior to the start of the moisture test. Figure

[9] Moisture contents herein reported are all expressed in per cent. of dry weight of the cord. These values are the same as those frequently referred to in the textile industry as "moisture regains."

[10] For a description of this test course see B. J. Lemon and J. J. Robson, **India Rubber World**, 109, 463 and 582 (1944).

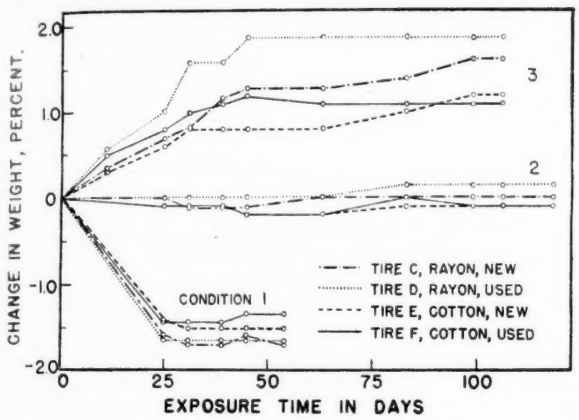


Fig. 2. Weight Change of Tire Sections during Exposure to Conditions 1, 2, and 3

1 is a photograph of the four tires before they were cut into sections.

For this experiment each tire was cut into five sections. One of each of these was set aside for immediate moisture analysis. Two others were sealed at the ends by dipping into melted paraffin wax to prevent moisture transfer through the exposed ends of the cords. These sections were used in the low-temperature exposure conditions. The remaining two sections of the original five were sealed at the ends by dipping into molten Acrawax C at 140° C. This synthetic wax with a melting point at about 135° C. served to reduce moisture transpiration through the exposed cord ends at the higher temperatures. Observation at the end of the conditioning time showed the wax seals to be relatively free from cracking.

One section from each tire was exposed to each of the following conditions:

CONDITION 1. Temperature, 185-200° F.; relative humidity, 2%; exposure time, 54 days. The temperature is approximately the mean between summer temperature and the extreme high of tire temperatures. The humidity is that obtained when the laboratory air is heated to about 200° F. without loss of moisture. This condition was achieved by means of a large forced-draft oven.

CONDITION 2. Temperature, 70° F.; relative humidity, 60-65%; exposure time, 118 days. This condition was that prevailing in the textile testing laboratory in which the tire sections were exposed.

CONDITION 3. Temperature, 80-95° F.; relative humidity, 90-95%; exposure time, 106 days. This condition was attained in a special cabinet into which air at the proper temperature and humidity was injected at a continuous rate. This air was produced by passing a mixture of air and steam through a radiator condenser which was kept at the prescribed temperature.

CONDITION 4. Temperature, 200-210° F.; relative humidity, 80-100%; exposure time, 70 days. This condition was attained in a special heated cabinet into which a small amount of steam was injected at a continuous rate.

Tire sections were suspended or supported in the cabinets described above, so that only water vapor, and not liquid water, would come into contact with them.

Humidities at the higher temperatures were determined by measuring the weight of water vapor contained for a given volume of dry air, calculating the partial pressure of the water vapor, and then evaluating the quotient of this partial pressure divided by the vapor pressure of water at the same temperature.

Sections under Conditions 1, 2, and 3 were taken out periodically and weighed to the nearest five grams (the sections averaged about four kilograms in weight) on a precision high-capacity scale in order to follow their approach to moisture equilibrium. The percentage of weight change for these sections with time is shown graphically in Figure 2. All sections at the high temperatures of Condition 1 appear to have reached approximate equilibrium in less than 25 days. No appreciable change was noted for Condition 2. Under Condition 3 the sections from tires D and F, both of which had most of the tread rubber worn off, reached a constant weight in about 50 days, whereas sections from C and E tires were still gaining in weight when the final moisture analysis was made. These results are in agreement with the fact that moisture diffuses through rubber more rapidly at high temperatures than at low temperatures, and with the findings of Lyons,[6] who showed that moisture diffuses out of a rubber slab more quickly than into it.

Moisture analyses of the sections exposed under each temperature and humidity condition were made as described above when it was thought the moisture contents were at reasonably stable levels. The results are tabulated in Table 3. The tabulation includes the average of the percentage of weight lost by the rubber in the oven drying process. Although this loss is probably largely one of moisture, there is some doubt concerning its completeness. Therefore the values reported for rubber cannot correctly be called moisture contents.

At the high temperatures and humidities of Condition 4, the synthetic rubber compound used in the tires suffered some deterioration, most noticeable on the outside layers of the rubber. This caused some difficulty in determining the moisture contents of the cords in ply one since it was not possible to make an accurate evaluation of the moisture lost by the outside rubber. For this reason the moisture contents for the tires under Condition 4 are only reported to the nearest per cent and, at least for the first ply, are subject to an error in experimental determination of not more than 3% in moisture content.

TABLE 3. MOISTURE CONTENTS OF CORD AND ADJACENT RUBBER IN TIRES C, D, E, AND F AS PER CENT. OF OVEN-DRY WEIGHT

Tire	Ply	Sample	Original	Conditions of Exposure (1) 185-200° F. 2% R.H.	(2) 70° F. 60-65% R.H.	(3) 80-95° F. 90-95% R.H.	(4) 200-210° F. 80-100% R.H.
			%	%	%	%	%
C—New Rayon	First	Cord	7.8	0.28	9.4	20.7	36
		Rubber	0.58	0.09	0.46	2.19	66
	Seventh	Cord	5.6	0.59	6.9	9.6	32
		Rubber	0.57	0.08	0.42	0.53	2.5
D—Used Rayon	First	Cord	6.7	0.37	9.3	17.1	45
		Rubber	0.68	0.13	0.70	1.66	24
	Seventh	Cord	4.1	0.71	6.9	11.0	39
		Rubber	0.42	0.06	0.41	0.48	4.7
E—New Cotton	First	Cord	3.8	0.17	4.8	10.4	17
		Rubber	0.46	0.11	0.90	1.57	31
	Fourth	Cord	....	0.23	4.2	6.4	17
		Rubber	....	0.08	0.68	0.77	4.2
	Seventh	Cord	3.0	0.28	3.8	5.0	18
		Rubber	0.64	0.08	0.61	0.68	2.1
F—Used Cotton	First	Cord	4.7	0.17	5.3	10.6	14
		Rubber	0.41	0.05	0.56	1.58	16
	Fourth	Cord	....	0.26	4.6	6.2	23
		Rubber	....	0.08	0.57	1.00	10.7
	Seventh	Cord	4.5	0.25	4.6	6.6	14
		Rubber	0.65	0.07	0.55	0.83	12.1

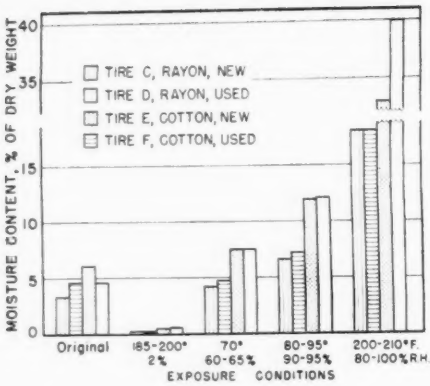


Fig. 3. Estimated Average Moisture Contents of Tire Cords after Exposure

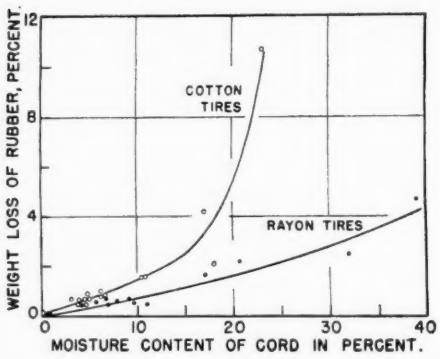


Fig. 4. Relation of the Per Cent. Moisture in the Cord to the Per Cent. Weight Loss Sustained by the Rubber in the Oven Drying Process

From the data in Table 3, from the known behavior of moisture sorption and diffusion through rubber, and from the physical features of the tires used in the test, an approximation of the average moisture contents of the cords in the tires was made. These are shown in the charts in Figure 3. These data show that the new and used tires of each type have approximately equal moisture contents after being exposed to the same conditions for periods ranging from two to four months. For the same conditions of exposure, the cords in cotton tires have a lower moisture content than the cords in rayon tires. This concurs with the data of Wiegerink[7] who found for rayon yarn a higher moisture content than that found for cotton yarn under identical conditions of temperature and humidity.

It is interesting to note from the results in Table 3 that the moisture weight loss for the rubber appears to be a function of the moisture contents of the cords in the same ply. When a dry tire is exposed to humid conditions, the rubber and cord would be expected to compete for the available moisture, since both materials take up water to a greater or less extent. Some idea of the relation between the water vapor uptake of the two substances may be obtained by plotting the moisture weight loss for the rubber against the moisture content of the cord for all tires. This has been done in Figure 4. There were found two distinct curves for this relation, one for the cotton tires and another for the rayon. The results indicate that both rayon and cotton are more hygroscopic than the rubber. When moisture diffuses into the tire, the moisture content of the fabric appears to increase much more rapidly than that of the rubber until the fabric approaches a fairly high value. After that the moisture in the rubber increases. Since cotton is less hygroscopic than rayon (see, for example, Wiegerink[7]), it does not seem surprising to find from Table 3 and Figure 4 that when cotton cord and rayon tire cord in tires have equal moisture contents, the rubber around the cotton cords holds more moisture than the rubber around the rayon.

Effect of Wheel Test Operation on Cord Moisture Contents

The experimental data described above do not completely satisfy the question of moisture contents of cords in tires because the effect of actual tire service might be considerably different from that of inactive storage. Truck tires operating on hot desert roads are known to develop rather high temperatures—conditions under which they might be expected to dry out sufficiently so that the tire fabric would lose most of its moisture. What would be the moisture content of cord in a tire after several days of such operation?

As a partial answer to this question the data in Table 4 are submitted. These results are from wheel tests made by the Armstrong Tire & Rubber Co., Natchez, Miss., and are for two pairs of rayon tires; the members in each pair differ only in the moisture contents of the cords built into the tires. It was not possible to evaluate the cord moisture in the tire immediately following vulcanization since this action would require damaging the tire. Actually, the moisture content of the cords probably increased somewhat during building and cure since the raw rubber compound contained varying amounts of water, some of which may have been given up to the cord. The significant fact found in Table 4, however, is that after approximately 15 continuous days on a wheel test during which the inside of the tire was, by actual measurement, at a temperature of approximately 200° F. the moisture contents of the rayon cords were still as high as 5.73%.

TABLE 4. MOISTURE CONTENTS OF WHEEL-TESTED 9.00-20, 10-PLY RAYON TIRES

	Moisture Content of Rayon Cord—%			
	Tire G	Tire H	Tire I	Tire J
Before entering drying cans	4.14	4.14	3.03	3.03
Immediately after leaving drying cans	1.25	1.25	1.66	1.66
Immediately before entering calendar	1.37	1.37	2.21	2.21
At bias cutter	1.44	1.44	3.06	3.06
At building machine	1.44	3.69*	3.06	7.25*
From wheel-tested tire (fifth plies)	3.21	4.67	5.62	5.73
		Wheel Test Data		
Room temperature—° F.	100	100	100	100
Maximum temperature in shoulder of tire—° F.	210	216	236	232
Miles run on test wheel†	4,102	4,106	6,119	10,965
Time of continuous running (at 30 miles per hour)—days	5.7	5.7	8.5	15.2

* The fabric for Tires H and J was allowed to regain moisture before being built into the tires.
†These mileages do not reflect tire performance since the tires were removed from the test wheel before failure.

Conclusions

The results of this investigation indicate that the enviromental condition is the most important determinant of the moisture content of the cord in the tire. When the surrounding atmosphere is more or less constant, as in storage, the tire cord probably assumes moisture values which are in equilibrium with the average of these conditions. In a humid climate the moisture content of the cords would be expected to be rather high. Even when the tire is operated under conditions conducive to high tire temperatures, considerable time is required for the cord to undergo appreciable moisture loss through the rubber.

These conclusions lead to a number of significant consequences. If the tire is built under conditions where the fabric is dry, say with 2-3% moisture content, there is no assurance that the moisture values will be maintained at these low levels. Conditions of climate and operation which will keep the cords fairly dry probably exist, but indications are that they are not common.

The moisture and temperature levels at which cords are tested in order to predict tire fabric performance should take into consideration the moisture contents of the cords in the tire. Dillon and Prettyman[11] have shown that tem-

[11] J. Applied Phys., 16, 159 (1945).

(Continued on page 721)

New Synthetic Rubbers Based on Methylpentadiene[1]

F. M. McMillan,[2] E. T. Bishop,[2] K. E. Marple,[2] and T. W. Evans[2]

IN DISCUSSING the potentialities of a new class of synthetic rubbers today, it is obvious that a different emphasis is required than would have been the case six months ago. The interest of the rubber industry in a given synthetic is no longer epitomized by the two questions: (1) Is it available? (2) Can it be used to make products that will at least get by under emergency conditions? Interest is now largely shifted to a third and more long-term question: What will be the place of this new synthetic in a field that includes natural rubber as well as the already established synthetic rubbers, all competing in a free or semi-free market?

While there seems to be virtually unanimous agreement that the synthetic rubbers are not going to be discarded and that the research programs aimed at their evaluation and improvement are not going to be abandoned or even curtailed, it is also generally agreed that any general-purpose synthetic rubber that will win an important place in the peacetime economy in competition with natural rubber will have to be better than the war-emergency GR-S both in quality and in processing characteristics. Among various research groups that have been working on synthetic rubber during the past five years the opinion has gradually developed and is fairly widespread that the synthetic rubber that will eventually solve a number of the processing and other difficulties that characterize many present-day synthetics will be essentially an all-diene polymer. In other words, it is felt that one of the most promising directions for development work on a good processing, general-purpose synthetic rubber is toward the production of polymers and copolymers of conjugated diolefins that contain either none or at most very small amounts of the highly polar molecules such as styrene, chlorinated compounds, or nitriles, that may contribute desirable special properties (such as oil resistance), but do not contribute to true rubber-like properties.

Until recently only a limited number of dienes have been available commercially. The deficiencies of straight butadiene polymers are only too well known; isoprene polymers are superior in some respects, but appear to have other deficiencies that limit their usefulness. In order to make progress in this field, therefore, research must attempt either to modify greatly the polymerization technique so as to produce superior polymers from the same dienes or, conversely, to discover other dienes that will more readily yield high-molecular-weight linear polymers with a relatively small and preferably controllable amount of branching and cross-linking.

An opportunity for new advances in this field is provided by the development of a commercial process for the production of a new polymerizable diolefin, methylpentadiene. The polymerization of methylpentadiene and the properties of its polymers and copolymers have been under investigation for several years, and the results of this work support the belief that all-diene polymers comprise a promising field for the development of improved synthetic rubbers. Of all the different types of polymers and copolymers that have been made in this laboratory using methylpentadiene, those in which it is the major component and in which the other component is another diolefin appear to have the most value for general application. Although development work is not complete, it has already demonstrated that these polymers have certain important advantages over both the standard synthetics and natural rubber that should enable them to do a better job in a number of specific applications.

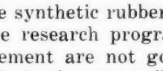
[1] Presented before the Northern California Rubber Group, Berkeley, Calif., Sept. 27, 1945.

[2] Shell Development Co., Emeryville, Calif.

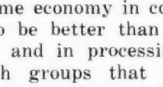
Properties of Methylpentadiene

Methylpentadiene is a reactive, doubly unsaturated, polymerizable hydrocarbon of the same type as butadiene, but it has a higher molecular weight and, hence, is a liquid, rather than a gas, at ordinary temperatures. It is more stable against polymerization in storage than butadiene; like butadiene, however, it readily forms peroxides in contact with air. Since methylpentadiene does not require pressure storage (its normal boiling point is approximately 76° C.), air contact is more likely to occur than is the case with butadiene. Care must therefore be taken to destroy any peroxides present before distilling methylpentadiene.

The commercial process for producing methylpentadiene yields a mixture of two isomers, the structure and properties of which are shown below:



2-methyl-1,3-pentadiene — b.p., 75.8° C.; refractive index, 1.4479



4-methyl-1,3-pentadiene — b.p., 76.7° C.; refractive index, 1.4534

It will be noted that both *cis* and *trans* forms are possible in 2-methyl-1,3-pentadiene, but not in 4-methyl-1,3-pentadiene. The commercial product contains approximately 85% of the 2-methyl and 15% of the 4-methyl isomer. Fortunately the two forms appear to be equally reactive in emulsion polymerization so that for practical purposes the commercial mixture behaves as a single monomer.

Notwithstanding the fact that both forms of methylpentadiene have only one terminal methylene group, polymerization proceeds, according to spectroscopic evidence, predominantly by 1,4-addition. However the polymerization rate is considerably slower than that of butadiene, and in order to obtain equivalent reaction rates, higher polymerization temperatures must be employed. A modified polymerization formula suitable for use at such temperatures is therefore required.

Polymerization of Methylpentadiene

Early work in these laboratories with methylpentadiene as a synthetic rubber raw material was directed toward the improvement of standard GR-S as a tire rubber by replacing 10 or 20% of the butadiene in the polymerization mixture with methylpentadiene. This action was found to give some improvement in tack and processing and also in tire performance, but the net gain was not considered sufficient to justify revision of the GR-S program for the production of tripolymers. Subsequently techniques were developed for polymerization of methylpentadiene alone, and this polymer proved to be quite different from GR-S and to have a number of very attractive properties. This development was therefore actively continued, and as a result, simple polymerization formulae are now available that can be used at temperatures in the neighborhood of 100° C. to polymerize methylpentadiene in an emulsion system, employing standard GR-S equipment and running to equally high yields in the same reaction time. The polymer is obtained as a latex which can be coagulated with the usual agents. The dried polymer has approximately the same specific gravity as GR-S.

This process has been operated on both laboratory and pilot-plant scale to produce polymers for laboratory test-

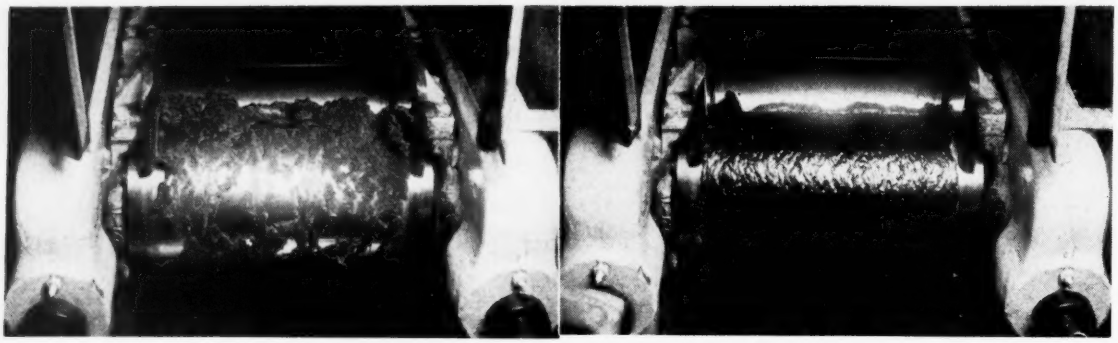


Fig. 1. Milling Tests

A. GR-S—Four Breakdown Passes at 0.035-Inch Clearance; 30 Seconds' Milling at 0.030-Inch Clearance

B. Polymethylpentadiene—30 Seconds' Milling at 0.065-Inch Clearance (No Breakdown Passes)

ing and for full-scale processing evaluation. The purpose of this development work is to demonstrate the potentialities of synthetic rubbers based on methylpentadiene; it is expected that commercial production of the polymers will be carried out by rubber manufacturing companies which have polymerization equipment.

Properties of Methylpentadiene Polymers

The most striking property of the unvulcanized polymer is its tackiness. Polymethylpentadiene, in both the crude and compounded states, exhibits more rubber-like tack, as distinguished from mere stickiness, than has been observed with the commonly available synthetics. Unlike natural rubber, polymethylpentadiene does not require mastication to develop tack, and the tack is retained in properly compounded stocks and is not lost during storage or exposure to air.

Plasticity of polymethylpentadiene can be controlled within wide limits by varying the polymerization conditions, and polymers ranging from hard tough rubbers to viscous liquids have been produced. In general these polymers are readily soluble in common hydrocarbon solvents such as petroleum naphthas, and the use of special aromatic or chlorinated solvents is unnecessary. The tendency is toward formation of high-solids-content and low-viscosity solutions; however the solubility of the polymer is subject to considerable control. All evidence indicates that methylpentadiene polymerizes to form long chains that show little tendency toward the cross-linking that would cause insolubility. The high solubility is not simply the result of low molecular weight, for molecular weight measurements made by both osmotic pressure and light scattering have given surprisingly high values. Light-scattering measurements by the method of Debye[2] have given weight-average molecular weight values for different samples ranging from 400,000 to 900,000. The intrinsic viscosities of the same polymers in isooctane solution were relatively low (0.7-1.6), suggesting an appreciable amount of branching without cross-linking. That the molecular weight distribution curve has considerable asymmetry is indicated by osmotic pressure measurements, which give number-average molecular weight values in the approximate range 150,000 to 250,000.

Presumably as a result of the very small amount of cross-linking, unvulcanized polymethylpentadiene is subject to viscous flow under prolonged stress. This tendency can be minimized by proper choice of polymerization conditions, but the most effective method of obtaining high creep resistance is to include a minor amount of butadiene in the polymerization mixture. Because of the marked tendency of butadiene to cross-link during polymerization, this offers a convenient means of controlling both creep resistance and solubility and of producing polymers with increased toughness and "internal strength." A copolymer of 80% methylpentadiene and 20% butadiene shows a desirable balance of properties from many standpoints, and data on copolymers of this composition are included in the following discussion as an example of the variations in properties that can be obtained. Other proportions of butadiene, and copolymers with other dienes, have also been studied and appear to offer a wide range of possibilities for synthesizing polymers to fit different requirements.

Another property of the crude polymers that deserves mention is their resistance to oxidation. Even in the absence of added antioxidant, unvulcanized polymethylpentadiene withstands surprisingly well exposure to air at moderately elevated temperatures. Whereas, if a Buna S or Buna N-type polymer is made without any antioxidant and placed into an air oven at about 80° C., it will be converted within a few hours to a crumbly, completely inelastic and partly charred mass; polymethylpentadiene suffers no such change; instead a gradual softening occurs. Samples heated for as long as three weeks in an air oven at 80° C. without added antioxidant showed considerable decrease in Mooney plasticity, but the aged polymers could be compounded and vulcanized to give properties not greatly inferior to those obtained with the unaged material.

Slow oxidation will occur, however, even at room temperature, and it is definitely advantageous to add an antioxidant to the crude polymer. Certain "non-staining" types have been found to give adequate protection, as well as the commonly used phenyl Beta-naphthylamine. Usual practice is to add these to the latex before coagulation.

Compounding and Processing Characteristics

The milling and processing characteristics of methylpentadiene polymers are outstandingly good; in fact, they appear to be superior to any of the available synthetics. Although it is difficult to demonstrate this by data or pictures, the photographs in Figure 1 afford one comparison in milling properties between the hard homopolymer (straight polymethylpentadiene) and GR-S. These milling tests were made by placing a 350-gram sample of polymer on a six-inch laboratory mill with cooling water at 50° C., sheeting as soon as possible, opening the mill as far as possible without losing the sheet, and photographing 30 seconds later. The GR-S sample required four grinding passes before the sheet could be formed at all, and the mill could be opened only to 0.035-inch clearance, giving the ragged sheet shown in Figure 1A. The polymethylpentadiene sample, on the other hand, was placed on the mill without any preliminary grinding and sheeted immediately. The rolls were then opened to 0.065-inch clearance, and the sheet remained free from holes, as shown in Figure 1B.

The good milling properties of polymethylpentadiene are due in large part to the thermoplasticity of the polymer. The Mooney plasticity of polymethylpentadiene decreases more rapidly with increasing temperature than is the case with GR-S. A polymer like that shown in Figure 1B had a Mooney of 82 at 40° C., but only 20 at 100° C. compared to 88 at 40° and 45 at 100° for GR-S. Thus the polymer softens rapidly, as it warms up on the mill, and mills with little heat generation and with low power requirement. Pigments and plasticizers are incorporated quite easily. The

[2] J. Applied Phys., 15, 838 (1944).

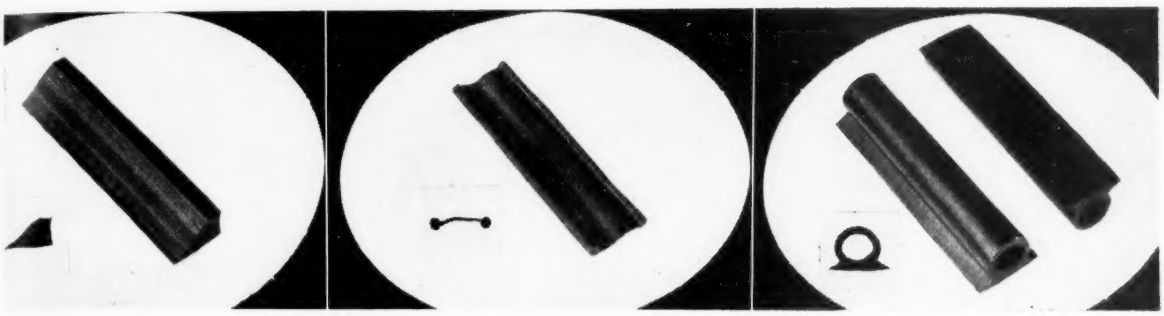


Fig. 2. Extruded Shapes Obtained with Polymethylpentadiene

TABLE 1. EFFECTS OF VARIOUS SULPHUR-ACCELERATOR COMBINATIONS IN COMPOUNDS OF METHYLPENTADIENE HOMOPOLYMER AND COPOLYMER

Recipe: Polymer 100. EPC Black 50. Bardol B 5.0 Zinc Oxide, Sulphur, Accelerators } as indicated

Polymer Composition	Homopolymer			Copolymer (80% Methylpentadiene—20% Butadiene)			
Sulphur, PHR	0.75	2.0	3.0	0.75	1.0	2.0	3.0
Accelerators, PHR	Altax 1.0 Litharge 1.5 ZnO 3.0	Captax 1.5 Tuads 0.4 ZnO 5.0	Captax 1.5 Tuads 0.4 ZnO 5.0	Altax 1.0 Litharge 1.5 ZnO 3.0	Captax 1.5 DPG 0.2 Tuads 0.2 ZnO 5.0	Captax 1.5 DPG 0.2 ZnO 5.0	Captax 1.5 DPG 0.2 ZnO 5.0
Cure, min. at 145° C.	90	30,45(av.)	30,60(av.)	120	30,45(av.)	60,90(av)	45,60(av.)
Tensile strength, p.s.i.	2020	1950	2120	2060	2300	2430	2370
Elongation, %	960	680	550	1100	710	610	520
Stress at 300% elong., p.s.i.	270	760	1120	320	700	1000	1140
Set at break, %	19	31	29	28	26	26	29
Tear, lbs./in.	245	355	390		480	320	345
Hardness, °/Shore	45	56	56		44	54	55
Rebound, %: at room temperature		8	8		12	12	12
at 100° C.		42	44		51	54	60
Cut growth, flexes/cm.	17000	7000	6800		6200	5500	11000

copolymer with butadiene is similar in behavior, but is somewhat less thermoplastic than the homopolymer; it therefore does not smooth out quite so quickly and gives slightly higher power requirement and milling temperatures, although still considerably better in these respects than GR-S. In compounding the very soft (low Mooney plasticity) polymers a cold mill is required to avoid stickiness.

As a further result of their thermoplasticity, the compounded polymers have relatively little "nerve," resulting in unusually smooth calendering and extrusion. The smoothness of extrusion that can be achieved is illustrated by the photographs in Figure 2. Three die shapes are shown: the Garvey pattern,[4] the Schultz and Bryant dumbbell pattern,[5] and an omega-shaped die that is used in this laboratory to evaluate four qualities: smoothness of a flat surface, conformity to dimensions, sharpness of a "knife-edge," and tendency to sag during cure. The samples shown were compounded with 125 PHR of SRF black and 20 PHR of softener. Similar sections were vulcanized in open steam without loss of shape.

Vulcanization

Vulcanization of methylpentadiene polymers is effected with the conventional curing agents used for GR-S and natural rubber; however the cure tends to be slower, and compensation for this slowness must be made in compounding. Sulphur requirements appear to be similar to those of GR-S or slightly higher; two or three parts per hundred of rubber is satisfactory for most types of compounds. The properties of the vulcanizate do not appear to be very sensitive to small changes in sulphur content. In the case of the homopolymer the best results have been obtained by acceleration with thiurams in combination with a thiazole or an aldehyde amine; such acceleration gives stocks that cure quite rapidly, but are not scorchy. The butadiene copolymer is faster curing than the homopolymer, being only slightly slower than GR-S. Satisfactory acceleration is provided by thiazoles activated by basic accelerators such as guanidines or aldehyde amines. Addition of stearic acid has proved to be unnecessary in vulcanizing methylpentadiene polymers made with the normal type of polymerization formula, since they already contain an adequate amount of fatty acid. Some typical data for compounds of the homopolymer and the butadiene copolymer with various sulphur-accelerator combinations are shown in Table 1. The test methods used in this investigation are described below. The litharge activated, low-sulphur cures are especially interesting, giving high elongation, low durometer stocks even when fully cured.

The most striking behavior of methylpentadiene polymers during vulcanization is the extreme "flatness" of the curing curve and the resistance to prolonged overcure. This behavior is illustrated by the curing curve shown in Figure 3, comparing channel black compounds of polymethylpentadiene, the butadiene copolymer, GR-S, and natural rubber. The recipes used for this comparison are shown in Table 2; they all contain a persistent accelerator (mercaptobenzothiazole) and are quite similar except that suitable secondary accelerators have been added to the methylpentadiene polymers to correct for their slower curing rate.

TABLE 2. RECIPES FOR COMPOUNDS SHOWN IN FIGURES 3 AND 4

Symbol	HP	CP	GR-S	NR
Polymethylpentadiene	100‡	..	..	..
Copolymer*	..	100‡	..	..
GR-S	..	..	100	..
Natural rubber (Smoked sheet)	..	..	..	100
EPC Black	50.	50.	50.	..
MPC Black	..	..	..	50.
Bardol B	5.0	5.0	5.0	3.0
Stearic acid	..	..	..	4.0
Mercaptobenzothiazole	1.5	1.5	1.5	1.0
Tetramethylthiuramdisulphide	0.4	..	..	..
Diphenylguanidine	..	0.2	..	..
AgeRite Powder	..†	..†	..	1.0
Sulphur	2.0	2.0	2.0	3.0

* 80% methylpentadiene—20% butadiene.
‡ Polymer contained 1.5% AgeRite Powder.

[4] **Ind. Eng. Chem.**, 34, 1309 (1942).
[5] **J. Applied Phys.**, 15, 360 (1944).

From Figure 3 it is evident that the tensile strength of methylpentadiene polymers is somewhat below that of GR-S, but there is practically no change in tensile strength in going from a cure of 20 minutes to one of 160 minutes. The modulus curve is more striking; here the familiar "marching" modulus of GR-S and the relatively high modulus of natural rubber are evident; whereas the methylpentadiene homopolymer is virtually unchanging from 30 minutes to 160 minutes. The butadiene copolymer is not quite so flat curing, but compares favorably with the controls. The elongation curves show a similar relation. Permanent set values for both the homopolymer and the copolymer fall between those of GR-S and natural rubber.

Like most other synthetics, methylpentadiene polymers do not develop high strength without adequate reenforcement, and carbon black appears to be the best reenforcing agent. X-ray diffraction and other evidence has so far failed to reveal any appreciable amount of crystallization in polymethylpentadiene.

Other properties of the vulcanized polymers are shown in Table 3, comparing the optimum cures of the four stocks described in Table 2. The methylpentadiene polymers have about the same durometer hardness and tear strength as GR-S, the homopolymer giving slightly higher values in both cases. Cut-growth resistance (measured at 100° C.) of the methylpentadiene polymers is several times as good as that of GR-S, although not in the same class as natural rubber in the unaged state. Rebound is considerably lower than for GR-S at room temperature, but equals or exceeds it at 100° C. The copolymer shows consistently higher resilience than the homopolymer. The freeze resistance of these polymers is inferior to that of GR-S, but copolymerization of methylpentadiene with butadiene improves this property. The stiffening of polymethylpentadiene at low temperatures may be attributed to interference of the side methyl groups with rotation of the polymer chain segments about the bonds adjacent to the double bonds, in accord with the theories of Bunn.[6] Tests made with various copolymer compositions have shown that the stiffening temperature is lowered in direct proportion to the percentage of butadiene in the copolymer. As would be expected from their all-hydrocarbon nature, the methylpentadiene polymers are not particularly oil resistant.

TABLE 3. SUPPLEMENTARY TESTS ON VULCANIZED POLYMETHYLPENTADIENE AND METHYLPENTADIENE-BUTADIENE COPOLYMER
(Recipes given in Table 2)

Symbol	HP	CP	GR-S	NR
Polymer	Polymethyl-pentadiene	Copolymer, 80% Methyl-Butadiene 20% Butadiene	GR-S	Smoked Sheet
Cure, min. at 145° C.	45	60	60	30
Durometer hardness	59	54	57	60
Tear strength, lb.-in.	420	330	390	840
Cut growth, flexes/cm	6800	5600	2100	710000
Rebound, %: at 25° C.	8	24	37	40
at 100° C.	47	54	47	55
Stiffening temp., °C.	—1	—9	—42	—47

Probably the most outstanding property of the vulcanized methylpentadiene polymers is their resistance to aging. The effect of oven aging on the four stocks described above is shown in Figure 4. These stocks were not compounded for maximum age resistance; hence they do not show the best that can be done with any of the different rubbers, but serve to compare inherent resistance of the polymers to air aging. Data are shown for two aging periods, seven days and 21 days at 80° C. As noted above, the initial tensile strength of polymethylpentadiene is only about half that of natural rubber; nevertheless at the end of the aging period the curves have crossed and the methylpentadiene polymer is the higher. GR-S, on the other hand, has a higher tensile strength than the methylpentadiene polymers both before and after aging. In retention of elongation there are striking differences; polymethylpentadiene does not drop appreciably below 500% elongation in 21 days at 80° C.; whereas both GR-S and natural rubber suffer severely. The butadiene copolymer drops to about 400% after seven days, but suffers little further loss. The modulus curves show corresponding effects; polymethylpentadiene shows virtually no change in 21 days' aging, and the copolymer shows considerable change at seven days, but little thereafter. Again, polymethylpentadiene starts with only half the tear strength of natural rubber, but at the end of the aging period is about twice as good as the natural rubber stock.

[6] Proc. Roy. Soc. (London), A180, 40 (1942).

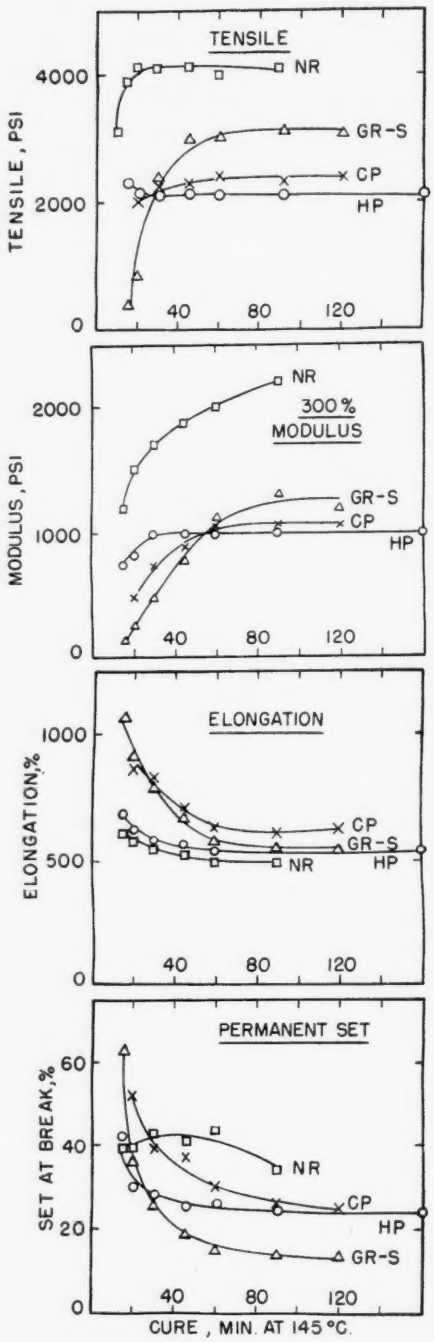


Fig. 3. Curing Curves for Polymethylpentadiene, Methylpentadiene-Butadiene Copolymer, GR-S, and Natural Rubber
Legend: HP—Homopolymer (Polymethylpentadiene)
CP—Copolymer (80% Methylpentadiene—20% Butadiene)
NR—Natural Rubber

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With Statex-B generally available due to increased production it is now possible for compounders to take full advantage of its quality-building properties. . . .

In heavy duty treads

Statex-B has an area of 8 acres, and a very narrow range of particle sizes. These characteristics contribute to a combination of

GOOD ROAD WEAR (**no coarse particles**)
LOW HEAT BUILD-UP (**no extremely fine particles**)

In inside tire parts

Stocks for carcasses, cushions and breakers made with Statex-B or Zinc Oxide are equally cool running, but Statex-B compounds show greatly improved flex life. Lower specific gravity results in less weight and a 5 to 10% reduction in volume cost in favor of the carbon stock.

Today's best answer to longer tire life is

STATEX-B

●

FURNEX
The High Resilience Carbon

MICRONEX *For 30 years*
the Standard Reinforcing Carbon

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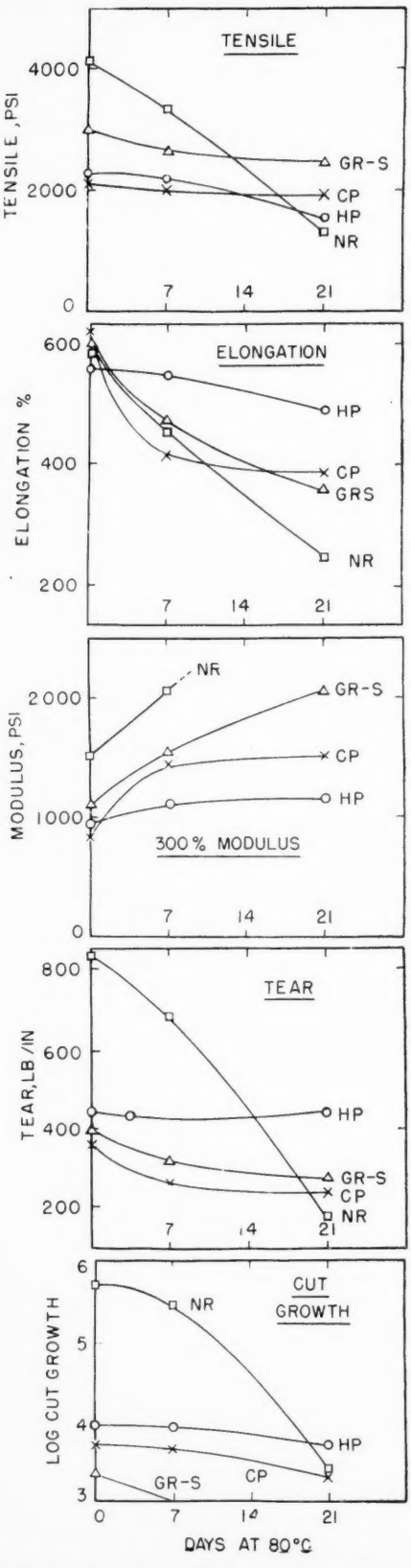


Fig. 4. Oven Aging Tests on Polymethylpentadiene, Methylpentadiene-Butadiene Copolymer, GR-S, and Natural Rubber

The comparison of cut-growth resistance before and after aging is of particular interest. Natural rubber in the unaged condition is so outstandingly good in this property that resort must be had to a logarithmic scale to plot it on the same graph as GR-S. However as aging proceeds, the natural rubber compound deteriorates rapidly and after 21 days has almost no cut-growth resistance; whereas polymethylpentadiene under the same conditions shows only moderate deterioration. GR-S is poor initially and loses almost all cut-growth resistance in 7 days' aging.

Practical Applications

This discussion has been confined to the general properties of polymethylpentadiene and of one type of copolymer and to the results of only the more common laboratory tests on a single type of compounded stock. No attempt has been made here to cover the results of more specialized tests on these compounds, or the development of compounds designed for particular applications, but the data cited permit some predictions as to the most promising fields of application for these polymers. Thus the controllable solubility, good age resistance, light color, and good tack of methylpentadiene polymers and copolymers suggest that they will be useful in several types of adhesives, such as leather and cloth adhesives, pressure-sensitive tapes, surgical tapes, and latex adhesives. Other fields of interest are in coated and impregnated fabrics and in laminated articles such as hose and belting where smooth processing, good tack and adhesion, and superior age resistance are required. Spreading doughs and friction stocks should be quite easy to make and use.

It is natural to inquire of any new synthetic whether it is good for tires; and of course the answer to this question was of great interest during the war years. Laboratory tests indicated that methylpentadiene-butadiene copolymer should make a satisfactory tire rubber in all respects except freeze resistance, and it was felt that the final answer to this question would be obtained only by actual service tests. A set of truck tires with treads made from the 80% methylpentadiene-20% butadiene copolymer was therefore constructed and road tested in the Sierra Nevada Mountains in below-freezing weather. Although performance was otherwise satisfactory, the treads became too stiff to function properly on prolonged exposure at temperatures around -10° C., and local cracking occurred on severe deformation. The testing of these tires was completed under ordinary conditions, and they were run an average of 18,500 miles in normal service before requiring recapping; the tread (non-directional military pattern) showed good resistance to cut growth and chipping.

Although this test confirmed the inadequate cold weather performance of this particular copolymer, it seems likely that a satisfactory tire rubber could be produced by using a copolymer containing a somewhat higher proportion of butadiene.

Other applications where the properties of methylpentadiene polymers appear attractive include use in wire insulation and other extruded and molded goods where smooth processing and good "knitting" are important and resistance to overcure and aging are required, in heat-resistant stocks, including air bags, and as blending agents to correct some of the deficiencies of other rubbers. The homopolymer is of particular interest for this latter application, and laboratory tests have demonstrated that the addition of 20 or 25% polymethylpentadiene to GR-S gives a quite useful degree of tack, smooths out the stock markedly, and improves its resistance to aging. It is of interest to note that the improvement in properties obtained in this way appears to be greater than that obtained by addition of 20% methylpentadiene monomer to the GR-S polymerization mixture. Blends with other synthetics might be expected to show similar effects, and combinations with natural rubber are also of interest, primarily from the standpoint of age resistance.

In conclusion it is emphasized that the polymers that

(Continued on page 714)

EDITORIALS

Rubbers, Plastics, Textiles— "High Polymers"

IN THE decade before World War II, interest in the basic relations between rubbers, plastics, textiles, and other natural and synthetic materials now known under the classification of "high polymers" grew steadily in scientific and technical circles. This interest ranged from the academic, where workers hoped by means of rapidly advancing scientific knowledge and with new research tools to contribute new fundamental facts on the structure and properties of matter, to the practical, where workers hoped by virtue of gaining a clearer understanding of these fundamental facts to improve their processing techniques and their final products.

With the necessity of the design, construction, and operation during the late war of a 1,000,000-ton-a-year synthetic rubber industry in the United States, industrial executives in the fields of rubbers, chemicals, plastics, and textiles, not only had to become acquainted with many new synthetics instead of the previously used natural raw materials, but also became conversant with what Leaderman, of the Textile Foundation, calls the contemporary viewpoint, "that the different materials possess distinctly different structures, but that all their structures are variations of one basic scheme." So it became generally known and agreed that these materials could all be considered as "high polymers" and this term applied whether they were of natural or synthetic origin. Since these high polymeric substances were explained to contain long molecular chains consisting of the same unit or similar repeating units and since the differences in properties were considered to be due to differences in the properties of these chains and the manner in which they were connected together, the importance of research on the structure of existing natural polymers and the possibility of the synthesis of "tailor-made" polymers for use in specific industrial product applications excited the imagination not only of directors of research, but also of top management of many companies.

As might be expected, however, it was in the scientific and technical societies where the first efforts were made to form groups or divisions for the discussion on an overall basis of two or more types of polymers. The American Society of Mechanical Engineers in October, 1939, approved formation of a Rubber and Plastics Subdivision (later a separate Division) of the Process Industries Division for the purpose of studying the engineering properties of these two materials. Reports of meetings of this Division and publication of papers presented (as abstracts or as complete papers) have appeared in INDIA RUBBER WORLD since 1938.

The American Physical Society at a meeting in Evanston, Ill., in November, 1943, was featured by a symposium on the physics of rubber and other high polymers, which in turn resulted in the formation of a Division of High Polymer Physics of the parent society. The inaugural meeting of the new Division was held as a part of a meeting of the American Physical Society in Rochester, N. Y., June, 1944, and a second meeting of the Division was held in New York, N. Y., in January, 1946. Reports of these meetings and abstracts of the papers presented have been or will be published in INDIA RUBBER WORLD.

A new venture along these same lines will be launched at the spring meeting of the American Chemical Society in April at Atlantic City, N. J., when a "High Polymer Forum," sponsored by the Society's Division of Paint, Varnish and Plastics and arranged with the help of the Divisions of Cellulose, Colloid, Organic, Physical and Inorganic, and Rubber Chemistry, will attempt to assemble together in a single program papers of broad fundamental interest on the chemistry of high polymers.

It might also be mentioned that beginning with February, 1946, publication of a new journal on high polymers is being started in this country.

There is, then, a definite trend in the research, development, and application fields for rubbers, plastics, and textiles to consider these materials on a much broader basis than formerly, i.e., as modifications of one basic structure. Such being the case, scientists and engineers in all types of activity in the rubber and allied industries should be encouraged to acquire this broader view of the relation of their work to that of workers in associated fields, either by attendance at meetings of the divisions of the various professional societies recently organized, as explained above, or if this is not possible, by keeping abreast with the most recent published literature on the subject.

Such an effort by the scientific and technical workers of the industry will require encouragement from management in the form of arranging for attendance of as many of these workers as possible to professional society meetings. Since industrial progress has become more and more dependent on advances in science and technology and since these previously more or less separate industries are now generally considered as having more in common than heretofore thought possible, it may be predicted that the company or companies in the rubber, plastics, chemical, or textile industries that keep abreast of the developments in all of these industries will be among the future leaders in its own field and possibly even in other fields.

Scientific and Technical Activities

Non-Oxidizing Resins for Pressure-Sensitive Tapes[1]

SIX non-oxidizing resins specially suited for use in making pressure-sensitive tapes are described in a recent issue of the *Hercules Chemist*. The resins are Pentalyns A and H, Staybelite Esters 1, 10, and 101, and Hercolyn, manufactured by the Hercules Powder Co., Wilmington, Del. Some one, or combination, of these resins with a suitable film-former should provide a good adhesive for most any sort of pressure-sensitive tape. As is indicated by the listing in Table 1, these resins are already in wide use in adhesives, serving as tackifiers for such film-formers as neoprene, GR-S, ethyl, cellulose, nitrocellulose, proteins, Styrene, vinyl resins, and Vistanex. Such adhesives are applied as hot melts, organic solvent solutions, or as water emulsions.

In addition to the properties shown in Table 2, each of these resins is characterized to a marked degree by nine properties particularly useful in the production of good pressure-sensitive adhesives. These properties are:

(1) Compatibility with most film-formers and waxes used in adhesives. This is brought out in Table 2. With regard to wax compatibility, sludging is not a real problem as, in some cases, the resin reduces the small amount of sludging exhibited by the wax alone, and the resins are being widely used commercially as the tack-imparting modifier for microcrystalline wax compositions.

(2) Stability to oxygen and heat. Natural rosins, while noted for native tack and other good qualities, suffer from ready oxidation and consequent loss of adhesive strength as well as from development of undesirable color. The good heat stability of the six resins permits their use in hot-melt adhesives applied at temperatures of 300-400° F.

TABLE 1. PARTIAL LISTING OF CURRENT INDUSTRIAL USES OF THE RESINS

As tackifiers in:
- GR-S latex adhesives—
  Pentalyn A and H and Staybelite Ester 10
- GR-S solvent cements—
  Pentalyn A and Staybelite Ester 10
- GR-S adhesives for masking tapes—
  Pentalyn A and Staybelite Ester 10
- Neoprene latex adhesives—
  Pentalyn A, Staybelite Ester 10, and Hercolyn
- Neoprene solvent cement—
  Pentalyn A and Hercolyn
- Vistanex adhesives for surgical tapes—
  Staybelite Ester 10 and 101
- Vistanex adhesives for masking tapes—
  Staybelite Ester 10
- Vistanex adhesives for shoes—
  Staybelite Ester 10
- Vistanex coating compositions—
  Staybelite Ester 10
- Vistanex cements—
  Staybelite Ester 10
- Laminating wax compositions—
  Pentalyn A and Staybelite Ester 10
- Sealing wax compositions—
  Staybelite Ester 10 and Hercolyn
- Ethyl cellulose solvent adhesives—
  Staybelite Ester 10 and Hercolyn
- Ethyl cellulose hot-melt compositions—
  Staybelite Ester 10 and Hercolyn
- Vinyl hot-melt compositions—
  Staybelite Ester 1 and 10 and Hercolyn
- Nitrocellulose solvent adhesives—
  Staybelite Ester 1 and 10 and Hercolyn
- Methacrylate adhesives
  Staybelite Ester 10 and Hercolyn
- Casein adhesives—
  Staybelite Ester 10 and Hercolyn
- Asphalt compositions—
  Hercolyn

(3) Good tack-imparting properties. The resins can be used to improve and retain the good tack contributed by rosin, especially in adhesives based on combinations of the resins with synthetic rubbers, Vistanex, and ethyl cellulose.

(4) Pale color. This good color, plus their good retention, promotes use of the resins in adhesives for cellulose-acetate and cellophane transparent tapes.

(5) Freedom from odor. Since these resins have no appreciable initial odor and do not develop odor during application, they are well suited for use in adhesives for food packages.

(6) Non-crystallization. These resins exhibit little or no tendency to crystallization in the adhesive, and are therefore suitable for use in surgical and transparent masking tapes.

(7) Good solubility. Table 2 gives data indicative of the ready solubility of these resins.

(8) Easy emulsification. Stable oil-in-water type of emulsion may be prepared from each of the six resins by use of simple equipment or colloid mills. Resin dispersions with average particle sizes well under one micron are readily prepared with Pentalyn H and Staybelite Ester 10.

(9) Low acid number. Allowable acid numbers are in the range of 5 to 12 for most resins, and as high as 18 in Pentalyn H alone. These resins with relatively low acid numbers are not subject to ready hydrolysis, show good practical stability in emulsions, and can be used as tackifiers in adhesives containing reactive pigments.

[1] Abstracted from **Hercules Chemist**, Oct., 1945. p. 14.

TABLE 2. PROPERTIES OF RESINS

Trade Name	Chemical Type	Analytical Data: Softening Point,* °C. Hercules Drop Method	Analytical Data: Softening Point,* °C. Ring and Ball Method	Analytical Data: Acid Number	Analytical Data: Color, U. S. Rosin Scale	Analytical Data: Density at 25° C.	Solubility Data †: In Hydrocarbons, Petroleum, Aromatic, Chlorinated	Solubility Data †: Ketones, Esters, Ether Alcohols	Solubility Data †: Alcohols	Compatibility Data: With Waxes‡	Compatibility Data: √—Indicates Compatibility with Film-Formers§: C, G, I, Ne, R, V	H, M, P	S, X	Ni	E	I
Pentalyn A	Pentaerythritol Ester of Rosin	112	105	12–16	M (max.)	1.08	S	S	PS	A & B Good	√					
Pentalyn H	Pentaerythritol Ester of Rosin	106	94	14–18	WG		S	S	PS	A & B Good	√				√	√
Staybelite Ester 10	Glycerol Ester of Hydrogenated Rosin	84	74	6–10	N–WG	1.08	S	S	PS	A & B Excellent	√		√	√	√	√
Staybelite Ester 101	Modified Glycerol Ester of Hydrogenated Rosin	77	67	6–10	N–WG		S	S	PS	A & B Excellent	√		√	√	√	√
Staybelite Ester 1	Glycerol Ester of Hydrogenated Rosin	55	48	8–12	N (max.)	1.06	S	S	PS	A & B Excellent	√		√	√	√	√
Hercolyn	Methyl Ester of Hydrogenated Rosin	Liquid at room temp.		5–8	X–Z	1.022	S	S	S	A & B Excellent	√			√	√	

* By Hercules softening (or melting) point method.
† Solubility data were run at a ratio of 1:1 parts (by wt.) of resin:solvent.
‡ A indicates ester-type waxes such as carnauba wax.
B indicates ester-type waxes such as paraffin wax.
§ Compatibility data were run at a ratio of 1:1 parts (by wt.) of resin: film-former. Absence of data means no tests made—materials may or may not be compatible.

PS—partly soluble.
S—soluble.
C—chlorinated rubber (Parlon).
E—ethyl cellulose.
G—GR-S.
H—cellulose acetate butyrate.
I—GR-I.
M—Methacrylate resin.
Ne—Neoprene.
Ni—nitrocellulose.
P—proteins, casein and zein.
R—reclaimed rubber.
S—styrene.
U—urea-formaldehyde resin.
V—vinyl resin.
X—Vistanex.

Use of Advertising Stressed

"THE Use of Advertising in Helping to Create Sales for New Products" was the title of an address given by B. W. Keightley before the Quebec Rubber & Plastics Group on January 11 at its meeting in the Ritz Carlton Hotel, Montreal, P. Q., Canada; about 100 persons attended. Mr. Keightley, advertising manager of Canadian Industries, Ltd., discussed the readiness of the buying public for new products. This attitude presents a danger of introducing new products that fail to measure up to expectations. Careful pretesting will be needed to avoid this, and advertising must stay within the bounds of known facts, warned Mr. Keightley. The change in advertising technique during the past 30 or 40 years was mentioned, from the technical announcement-advertisements of the past to the detailed and imaginative advertisements of the present. For this type of imaginative advertising, Mr. Keightley stated, men are needed who, in addition to possessing the quality of imagination, are also business men capable of working with the sales department and making contributions worthy of incorporation into the general sales plan.

The most successful meeting in the history of the Quebec Rubber & Plastics Group was the Annual Ladies' Night, held December 13, in the Ritz Carlton Hotel, Montreal, P. Q., Canada, with about 250 persons attending. The guest speaker was A. F. Caprio, chemist of the Celanese Corp. of America, Newark, N. J. The distinguished woman chemist, Marie Bentivoglio, of the same company, had previously been scheduled to speak at the meeting, but was obliged to cancel the engagement owing to illness. Mr. Caprio spoke on "What Can We Expect of Plastics?" and displayed samples of plastics to illustrate the advances and wide application of plastics for both peace and war. After the address, a movie entitled "Proving Ground" was shown. In addition to technical subjects, a program of songs was presented.

GR-S Retarder

VULTROL, made by the B. F. Goodrich Chemical Co., Rose Bldg., Cleveland 15, O., is recommended for use in GR-S stocks where an improvement in scorching characteristics is desired. It is effective with mixtures of mercaptobenzothiazole and diphenylguanidine, with tetramethyl thiuram monosulphide, and with a number of other accelerators. With straight mercaptobenzothiazole acceleration, Vultrol acts as an activator. The recommended ratios are from 0.10- to 0.25-parts Vultrol to 100 parts of rubber, although higher ratios may be advantageous in special cases.

The addition of Vultrol to scorched stocks of GR-S when they are remilled or refined makes the stock process more smoothly and, after cure, brings the properties closer to those of the original stock. For this use 1% of Vultrol on the stock is recommended. It may be used alone, or it may be dissolved in an equal weight of soft coal tar by gentle heating.

Rubber Division—Spring Banquet

THERE will be an advance sale of banquet tickets for the Rubber Division banquet, Thursday, April 11, at Atlantic City, N. J. The sale will be restricted to members and associate members of the Division of Rubber Chemistry, American Chemical Society, until March 15. After this date, tickets will go on general sale to members of the A.C.S. and guests who wish to attend the dinner. The tickets will be $5 and may be purchased by addressing the request to Wm. B. Dunlap, Jr., Lee Rubber & Tire Corp., Conshohocken, Pa., Chairman—Ticket Sub-Committee.

Holds Victory Convention

NEW textile products and processes developed during the war and the possibilities of converting these developments to peacetime use were discussed at the Victory Convention of the American Association of Textile Chemists & Colorists held January 3-5 at the Hotel Pennsylvania, New York, N. Y.

Under the general chairmanship of Emmett J. Driscoll, exhibits were shown of new fabrics and processing equipment, the use of these fabrics for the Armed Services, and the work being conducted by the Association on textile testing methods. A panel of speakers, including F. Bonnet, of American Viscose Co., Harold DeWitt Smith, of A. M. Tenney Associates, and George J. Groh, of E. I. du Pont de Nemours & Co., Inc., discussed developments in the fields of viscose, acetate, and nylon, respectively.

Dr. Bonnet pointed out the remarkable increase in production of viscose rayon during the war, with some 137 million pounds produced during the first nine months of 1945 as compared to only nine million pounds for 12 months in 1939. He stated that the general information gained in spinning the strong and regular yarns led directly to the development of semi-strong yarns of only one denier per filament. Such fine multifilament yarns as, for example, 100 denier with 100 filaments, or 75 denier with 75 filaments, have made it possible to produce many new and attractive fabrics whose characteristics are quite different from those using the prewar type of rayon with heavier filaments. The expansion of rayon staple production, particularly viscose staple, promises to be extensive. New applications include the production of a tea bag paper using Vinyon for heat-sealing properties, the production of a pillow stuffing for individuals suffering from allergy to feathers, and use in upholstery stuffing and baseball windings. Rayon staple of one denier per filament has been spun into very fine yarns for handkerchiefs, and there have been several interesting fabrics in which rayon has been combined with fur hair or cotton.

Other speakers included D. H. Powers, of Monsanto Chemical Co., on the subject of "Textile Plastics"; and Raymond A. Pingree, of Warwick Chemical Co., on "Water Repellents." In addition were many general and sectional papers presented on textile technology.

Connecticut Rubber Group Formed

THE Connecticut Rubber Group, a new organization, has been formed to promote a better understanding of current rubber technology among the members of the rubber industry in that area. The Group will hold its first meeting at the Public Library, Bridgeport, Conn., on February 15. Warren Lockwood, executive vice president of The Rubber Manufacturers Association, Inc., will speak on the present and future availability of natural rubber and present his opinions of the natural rubber *versus* synthetic rubber picture. In addition, William Sparks, of Standard Oil Development Co., co-inventor of Butyl synthetic rubber, will give a short extemporaneous talk on "Specialty Synthetic Rubbers of the Future."

A short business meeting will be held to select from the floor a nominating committee which will, at a later date, present the Group with a slate of permanent officers. A temporary executive committee was formed in October, 1945, consisting of the following officers: chairman, Roger Bascomb, B. F. Goodrich Chemical Co.; treasurer, Edward Butler, General Electric Co.; secretary, Robert Holmes, Raybestos-Manhattan, Inc. Other members of the temporary committee are Ralph Norton of Kerite Wire & Cable Co., Milton Greenhalgh, of General Electric Co., Hugh Allison, of Allison Co., George Sprague and Don Spengler, of Sponge Rubber Products, and George D'Olier, of Raybestos-Manhattan.

Detroit Group Party

DETROIT RUBBER & PLASTICS GROUP, INC., held its Christmas party at the Detroit-Leland Hotel, Detroit, Mich., December 14. In addition to a dinner attended by 185 members and guests, musical and acrobatic entertainment was furnished, and door prizes were distributed.

Speaker of the evening was Webster N. Jones, director of the College of Engineering, Carnegie Institute of Technology, whose topic was "Engineering Tomorrow." Dr. Jones stressed the need of a complete change in educational policy to provide adequately for refresher courses, graduate study, and counseling of veterans desiring to renew their education with the aim of attaining professional status. He reviewed the policy at Carnegie Tech, which stresses basic science, technical or engineering courses, and humanistic-social studies in an attempt to provide a balanced background and make the engineer a leader not only in his profession, but in the world at large. Dr. Jones discussed the great need of graduate engineering work growing out of the war, especially research of a distinctly fundamental nature.

The Group elected officers for 1946, as follows: chairman, J. R. Shroyer, R. T. Vanderbilt Co.; first vice chairman, Paul Wilson, Ford Motor Co.; second vice chairman, Gordon Saunders, Dodge Main Plant; secretary-treasurer, E. J. Kvet, Baldwin Rubber Co.; assistant secretary-treasurer, C. W. Selheimer, Wayne University; educational committee, Fred Wehmer and James McClellan, Minnesota Mining & Mfg. Co.;

membership committee, William Davies, Thiokol Corp., and Vernon Meyers, Corduroy Rubber Co.; program committee, Fred Haushalter, Baldwin Rubber, and R. C. Knapp, United States Rubber Co.; entertainment committee, Tom Halloran, Chemical Products Co., and George Horsphal, American Cyanamid Corp.; publicity chairman, N. L. Schreiber, Paramount Rubber Co.

Philadelphia Group Election

THE Philadelphia Rubber Group held its winter meeting on January 4 at the Benjamin Franklin Hotel, Philadelphia, Pa. More than 115 members and guests attended. Entertainment provided during and after the dinner included accordion music, a song program, and a juggling act.

Speaker of the evening was B. S. Garvey, Jr., of The B. F. Goodrich Co., who gave a talk on his trip through Germany with a rubber intelligence team sent over to study German synthetic rubber production methods. The speaker described the trip and some of his personal experiences. Comments were made on general conditions in Europe and on some of the plants investigated, with illustrations by picture slides taken during the trip. Dr. Garvey stated that in compounding, processing, and tire making the German practice was behind the American. Methods of making synthetic rubber were similar, but the investigators concluded that, over all, the American industry was more highly developed. The tough German Buna S was not so well adapted to volume production of tires as is GR-S. The only exception to American superiority was the German tackifier, Koresin.

Elections for officers of the Group for 1946 were held, and the following elected: chairman, W. B. Munroe, Linear Packing & Rubber Co.; vice chairman, L. K. Youse, L. H. Gilmer Co.; secretary, T. T. MacConnell, U. S. Rubber Reclaiming Co., Inc.; treasurer, W. B. Dunlap, Jr., Lee Rubber & Tire Corp.; board of directors, William Ayscue, E. I. du Pont de Nemours & Co., Inc., and D. E. Henderson, Associated Rubber Products Co., for three years each; Ralph Davis, MacEwan & Smith Inc., and B. F. Benson, B. F. Goodrich, two years each: V. H. Perrine, Thiokol Corp., and C. H. Fisher, U. S. Eastern Regional Laboratories, one year each.

Experimental GR-S and GR-S Latices

Additions to the list of experimental GR-S dry polymers and GR-S latices available for distribution to rubber goods manufacturers from the Office of Rubber Reserve, RFC, under the conditions outlined in our November, 1945, issue, page 237, have been received and are listed below:

X-Number Designation	Manufacturing Plant	Date of Authorization	Polymer Description	Special Characteristics
X-280-GR-S	Goodrich-Port Neches	12/18/45	Same as GR-S-10 with a minor change in plant practice to achieve higher production rate.	Same purpose use as GR-S-10
X-281-GR-S	Goodrich-Borger	1/10/46	Polyisoprene	Produced for uses as an intermediate material in chlorinated and other chemically treated end-products. Similar in chemical properties to natural rubber.
X-282-GR-S	Goodrich-Louisville	1/14/46	GR-S-10 made by continuous polymerization	Same purpose use as GR-S-10.

A.S.T.M. Meeting Notes

THE spring meeting of the American Society for Testing Materials will be held at the Hotel William Penn in Pittsburgh, Pa., the week of February 25. Technical features planned for February 26 and 27 include several papers relating to statistical quality control and its relation to specifications. For many years A.S.T.M. has had a committee dealing with the presentation and interpretation of data, which has issued a widely read manual on this subject. A new technical committee on quality control of materials has been announced, to be headed temporarily by H. F. Dodge, of Bell Telephone Laboratories, Inc.

Throughout the week of February 25 there will be almost 200 meetings of A.S.T.M. technical committees in Pittsburgh. Sessions scheduled include those by Committee D-1 on Paint, Varnish, Lacquer, and Related Products, and Committee D-11 on Rubber and Rubber-Like Materials. Following the meetings the committees will conduct letter ballots of the actions taken, and most of these will be covered in the annual reports to the Society which will be presented at the 1946 annual meeting.

The annual meeting will be held at the Hotel Statler, Buffalo, N. Y., during the week of June 24. Also under way at this time will be the seventh A.S.T.M. Exhibit of Testing Apparatus and Related Equipment, and the Annual Photographic Exhibit. In addition to the some 15 to 20 technical sessions necessary for the program, there will be a large number of meetings of the Society's technical committees. The annual Edgar Marburg Lecture, always a feature of the meeting, will be presented this year by J. J. Mattiello, technical director of the Hilo Varnish Corp., on the subject "Protective Organic Coatings as Engineering Materials."

The Philadelphia District of A.S.T.M. will hold a meeting on Housing and Housing Materials at the Franklin Institute on February 14. Another meeting planned by the Philadelphia group is a symposium on effect of low temperatures on materials in which there will be included a paper on plastics and one on rubber and rubber-like materials.

Chicago Group Celebration

THE fifth annual Christmas party of the Chicago Rubber Group was held December 21, 1945, at the Morrison Hotel. Arranged by a committee under the chairmanship of Bob Elliot, the party was the largest held by the Group to date. A cocktail hour followed by a full-course turkey dinner was thoroughly enjoyed by the 550 persons attending. The ladies were presented with Lucite compacts, and entertainment was provided.

Bibliography of OPB Reports

THE first issue of the "Bibliography of Scientific and Industrial Reports Distributed by the Office of the Publication Board" was placed on sale January 25 by the Superintendent of Documents, Government Printing Office, Washington, D. C. Succeeding issues of the bibliography are to be made available on a weekly basis. Reports listed will be grouped according to subject matter, with the serial number, price, length, title, and a brief description of the report's contents. The information contained in the reports was previously subject to security restrictions, but has now been released for distribution by OPB. Most of the information released to date was obtained in Germany and in countries formerly occupied by the Germans. Some reports on U. S. Government sponsored research also have been released, and many more are expected to be made available for distribution in the future. The first issue of the bibliography comprised 28 pages and covered 323 reports, listed under various headings which included rubber products, with 11 titles, and chemicals and allied products, with 114 titles.

Boston Group Party

THE Boston Rubber Group held its Christmas party on December 21, 1945, in the Copley Plaza Hotel before a total of 330 members and guests. Dinner was preceded by a cocktail hour, and the entertainment consisted of six vaudeville acts. Seventy-two door prizes were distributed. "Germany Via Jeep" was the title of a talk given by the principal speaker, W. E. Kavenagh, manager of the development department, Windsor Mfg. Co., who spoke of his experiences on a recent trip through Germany. Other guests of honor included Harry Martin, of Hood Rubber Co., and Mr. Johansen, of the Royal Norwegian Purchasing Committee.

The business meeting consisted of a financial report by Secretary-Treasurer C. E. Reynolds, and the election of officers for 1946 under the chairmanship of Ralph Huber. Officers elected were: chairman, James R. Geenty, of Goodall-Sanford, Inc.; vice chairman, Charles E. Reynolds, Cambridge Rubber Co.; secretary-treasurer, Richard K. Patrick, Windram Mfg. Co.; executive committee, Bernard Capen, of Tyer Rubber Co., and John H. Clarke, of Hood Rubber Co.

The next meeting of the Group will be held in the Copley Plaza Hotel on March 8. The speaker for this meeting will be announced at a later date.

Plastics Technology

Recent Significant Developments in Plastics[1]

Robert J. Moore[2]

FOR the active members of the Rubber and Plastics Division, A.S.M.E., it is obviously unnecessary to outline recent developments in plastics. Each member is aware of the progress in the field. But many other engineers who have not the opportunity for such specialization are nevertheless keenly interested in the advances in plastics, particularly as to engineering and construction values, and their use with, and impact on, other standard materials, such as metals, wood, glass, paper, and textiles.

Ramifications and Growth

Plastics denote materials which may be molded or cast to a desired shape. But the plastics industry today has extended far beyond these original boundaries. In addition to molded and cast materials are the large fields of laminated products; the bonds and adhesives; the foils, rigid and flexible sheets and films. The latter group alone embraces comprehensive industries, such as packaging and display materials, and instruments for drafting and scientific work. In plastics also we have the base materials for protective and decorative coatings and the resin applications to paper and textiles. The bonds and adhesives group just mentioned in turn embraces entire industries, such as brake linings, grinding wheels, plywood glues, core bonding, and the resin bonds for mineral and glass wool heat insulants; also the fast-growing field of cements and bonds for joining the entire range of surfaces. The extrusion and calendered products and dielectrics cover in turn the electrical insulation industries, the wire and cable compounds, and the entire field of textile surfacing and treatments. For paper there are not only the various surfacing materials used in packaging, but the resin treatments for increased wet-strength. Other substantial divisions of the plastics industry are the films and fibers used for coverings, curtains, upholstery, bristles, and yarns. Synthetic resins are used increasingly to modify the properties of synthetic rubbers. Plastics sheeting and calendered compositions are proving increasingly valuable for shoe soles and uppers, belts, etc., where formerly leather alone was used. New types of construction materials are now available to the modern designer involving laminates or plywood with lightweight inner cores or resin foams to give strength combined with lightweight and buoyancy. We are omitting from detailed discussion the tremendous synthetic resin developments in man-made rubber and textiles. Buna S, Buna N, Butyl, "Thiokol," neoprene, in rubber are as familiar to the public as are nylon, rayon, vinyon in textiles.

The plastics industry has extended far beyond its original scope when in 1907, Dr. Leo H. Baekeland announced the control of the phenol-formaldehyde reaction; when in 1909, Westinghouse Electrical Mfg. Co. had used a solution of this resin in alcohol to treat paper for insulating purposes; when in 1910, Boonton Rubber Co. used a molding powder based on this resin to produce a small electrical part for the Weston Electric Instrument Co. The ramifications since then and the impact on other materials and other industries suggest that the plastics industry has outgrown its name and might well be considered as the synthetic resin industry.

With this increase in scope and continued improvement in products has come a remarkable growth in the plastics industry. The WPB recently announced that 1944 showed a 325% increase in dollar volume of plastics over 1939: for 1939, $71,900,000; for 1944, $332,000,000 (1).[3] The total production of last year (1944) amounted to 784,137,000 pounds, of which 404,105,000 pounds were of the so-called coal-tar derivation, while 380,032,000 pounds were of the non-coal-tar (non-cyclic) origin. In addition over 80,000,000 pounds of cellulose base plastics were used (2).

Aside from the expanding usefulness of plastic material as such, the industry has kept pace with the specific requirements of new developments in engineering industries. With each succeeding new industry during the past 20 years have come plastic products to meet these new demands: automobile electric ignition and starting systems, insulation requirements in telephone and telegraph, aircraft, radio, high-frequency techniques, more recently radar, television, and even to essential parts in the atomic bomb.

The recognition given to plastics during the recent war has kindled a remarkable public interest in synthetic resins and their utility. Books, magazines, daily papers, and the radio have featured new products and have prophesied fanciful developments. With this has occurred, perforce, a certain amount of prodigal language and perhaps exaggerated, if not absurd, claims.

As W. J. Connelly (3) recently expressed it, "Unfortunately, to listen to some, plastics are going to revolutionize the industrial world—going to replace glass—wood—iron—cotton and wool. Still listening, you may hear that plastics are far stronger than steel, clearer than glass, lighter than aluminum and cheaper than dirt!"

It is true that plastics have many outstanding properties and are being used in an ever-widening field of applications. But their utilization depends on specific engineering properties which indicate merit over older materials, and frequently in combination with such materials as wood, metals, glass, paper, and textiles.

Recent Significant Developments

With the ending of the war many of the applications of plastics to military uses were released from secrecy; others are still held confidential, but may be released during this year. The story on these uses has been appearing in the literature of plastics (4). Added to this important phase of the story of plastics has been the concomitant conversion of military materials to civilian and industrial uses. The entire story involves new methods of processing in manufacture and in fabricating the product, new materials, and new end-uses.

Classification of Plastic Molding Materials

Of significant interest to the plastics industry and to the engineer who is using these materials is the appearance this year of two published classifications. The first is "Technical Data on Plastics," a comprehensive volume which was published in April, 1945, by the Plastics Materials Manufacturers' Association (5). This gives an authoritative listing of the properties of all commercial plastics for molding, laminating, calendering, and extrusion. Its purpose is to acquaint the user with the nature, particular merits, and utility of various plastics with property values as measured by approved methods.

The second classification was a large tabulation (6) issued last summer by the Society of the Plastics Industry. This is a systematic classification to promote and encourage the intelligent use of plastics and to supply an engineering approach to the selection of the proper plastic material. It represents two years of work by nearly a score of leading technicians of the industry.

Heatronic Molding

Of outstanding significance to those who are watching the growth of thermosetting molding materials has been the impressive increase in the use of electrostatic high-frequency heating. The method was first announced by V. E. Meharg (7) as recently as March, 1943. It makes possible the successful molding of much larger or thicker molded parts than heretofore and with substantial saving in time. It accomplishes the molding of impact-resistant material as readily as the general-purpose wood-filled materials. It makes practical the molding of pieces thicker than ⅜-inch from thermosetting materials. Pieces 2½ inches thick in sections may now be molded in ten minutes; while thin pieces mold in seconds. (See Figure 1.) With the release of high-frequency equipment from war work the industry is rapidly changing over to this process of heating for many types of moldings. It was recently estimated that, with the first application only about two years ago, today over 40% of all the phenolic materials are being molded using this so-called "heatronic" method. Continued growth is expected.

Low-Pressure and Contact Pressure Laminating

The development of special resins and new techniques utilized to produce ur-

[1] Presented before the American Society of Mechanical Engineers, Rubber and Plastics Division, annual meeting in New York, N. Y., Nov. 27, 1945.

[2] Technical coordinator, Bakelite Corp., New York, N. Y.

[3] Bibliography references appear at end of article.

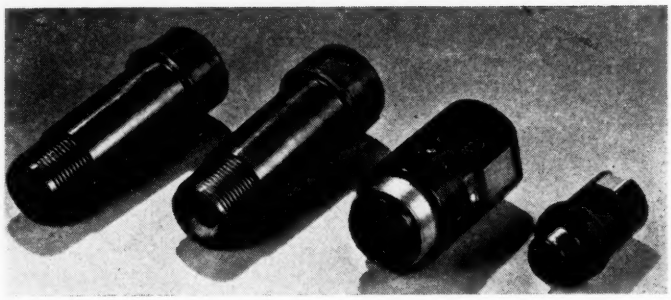


Fig. 1. Heatronic molding reduced the molding cycle of these portable marine light handles and waterproof connector panels to approximately one-half the length of time required for straight molding



Fig. 2. The hull of this boat is an example of a structure composed of two outer layers of lightweight duck, a low-density core of sisal fiber matting, and an inner layer of heavy duck, all impregnated with a special compound based on polyester-styrene laminating varnish and formed by the low-pressure rubber-bag molded process

TABLE 1. COMPARATIVE PROPERTIES* — LOW-PRESSURE LAMINATED FIBERGLAS — STYRENE POLYESTER RESIN *vs.* 24 ST ALUMINUM AND STRUCTURAL STEEL

	Fiberglas—Laminate			
	Cross Laminated	Parallel Laminated	24 ST	Steel
Impact strength—ft.-lb. per inch notch	30	54	24	45
Modulus of elasticity in tension (p.s.i.)	2.5×10^6	4.2×10^6	10.5×10^6	29×10^6
Tensile strength (p.s.i.)	55,000	77,000	40,000	45,000
Compressive strength (p.s.i.)	54,000	68,000	43,000	45,000
Flexural strength (p.s.i.)	84,000	113,000	64,000	45,000
Specific† tension (p.s.i.)	31,500	44,000	14,300	5,770
Specific† comparison (p.s.i.)	30,800	38,800	15,300	5,770
Specific† flexure (p.s.i.)	27,400	36,800	8,200	740
Specific† impact (ft.-lb. per inch notch)	17.1	31	8.6	5.8
Specific† modulus (p.s.i.)	1.4×10^6	2.4×10^6	3.75×10^6	3.7×10^6

* See bibliography reference (11).
†Note—Specific tension and specific compression are obtained by dividing the strength values by the specific gravity of the material. Specific flexure is the flexural strength divided by the specific gravity squared. Specific impact is the impact strength divided by the specific gravity. Specific modulus of elasticity in tension is obtained by dividing the tensile modulus by the specific gravity.

gently required war materials, today is opening up entirely new fields in civilian and industrial use. The standard high-pressure laminated products played a conspicuous part in war material. These use a pressure of over 1000 p.s.i., and therefore output was somewhat limited owing to equipment. To increase the volume of production and to simplify equipment, low-pressure setting resins were developed requiring less then 1000 p.s.i. (many in the range of 100-300 p.s.i.) and utilizing rubber bag molding technique. This was followed by resins which molded at 15 p.s.i. or less, the so-called contact pressure resins. Cheaper and more readily obtainable mold materials were utilized, such as cast alloys, wood, plaster of Paris, etc. As frequently happens, the replacement material was found to have genuine advantage in many types of use. The technique employed of forming flat, simple or compound-curved surfaces in material that may be molded to permanent shape at low pressures, extends to many types of laminates as well as to molded plywood and plastic forming operations. A recent review by Chas. B. Hemming explains the details of low-pressure molding (8).

The new combination of special filler materials (such as Mitscherlich paper, woven glass fiber, sisal, etc.) with newly developed resins (low-pressure phenolic, contact pressure styrene-polyster types, allyl esters) has given the industry an increased range in values. Among these are exceptional strength values, good dielectric strengths and power factors and, most important, the ability to fabricate large areas, molded to contour, by relatively inexpensive methods. (See Figure 2.)

Fiberglas fabric as the reenforcing material in low-pressure laminating was one of the most important developments in the recent war years and now looms as a significant factor in plastics development (9). Used with styrene-polyester thermosetting resins it answered the war requirement for liners for aircraft gasoline tanks, as the housing for radar under the name Radomes (10), and numerous other uses. The combination is strong, highly water resistant, and with interesting electrical qualities. For example, dielectric constants at one million cycles of 2.7-2.8 and power factors of 0.004-0.008 were achieved. The strength properties of the low-pressure phenolic and the styrene-polyester combinations with Fiberglas are of unusual interest in that they begin to approach values which the structural engineer demands. A range of recent values showing comparison with 24 ST aluminum and with structural steel is given in Table 1. It shows impressive values for impact, tensile, compressive and flexural tests, but lower values than the metals in modulus of elasticity. When we consider that the density of these laminates may be as low as 1.69, approximately one-half the weight of aluminum or one-fifth the weight of steel, the values indicate extensive expansion in fields of light construction, luggage, packaging, etc. Recently experimental auto bodies of this type of plastic, as light as magnesium, were shown which will not dent under a blow that would bend a steel body job (12).

Cellular Core Laminates

A further development especially in the aircraft war program was the introduction of lightweight-high strength "sandwich materials," consisting of foamed or "expanded" resins, blown rubber, balsa wood, or other light density material surfaced top and bottom with a sheet of rigid low-pressure laminated material (13). For example, a cellular core material alone, requiring little strength to break, when surfaced top and bottom with thin sheets of glass cloth, laminated, requires an astonishing force to break. Reeves (9) cites the loads required to break 12- by 24-inch panels of aluminum, commercial plywood, and Fiberglas laminated sandwich material, each having the same weight of 1¼ pounds per square foot. The relative breaking weights were as follows:

	Lbs.
Aluminum	197
Plywood	483
Cellular core laminated	1,163

Industrial applications of these lightweight structural materials are appearing in fields of luggage, building partitions, and walls, especially in prefabricated buildings, and self-supporting floorings for airplanes, boats, and automobiles. The high insulation value of the cellular core also makes them of interest in refrigeration work.

Expanded Resins

We have just discussed lightweight sandwich construction containing cellular material. The first used in laminated types of construction were balsa wood and then blown rubber. There followed developments in resin expanded foams, of which several types are now available. Some of these are of the styrene-polyester thermosetting resins and produce sealed interstices giving a non-permeable, multicellular mass of very low density. Another type, consisting entirely of thermoplastic polystyrene, has been recently described (14). Weights as low as 1½ to two pounds per cubic foot may be obtained. Besides insulation value and cellular core usage, they have excellent electrical properties, water-proofness, and water-buoyancy. Another-type thermosetting foam is produced by activating a liquid phenolic resin to give a low density and a "K" value of 0.24, one of the lowest recorded for an insulating material. This value indicates the flow of heat per unit time through a material; the lower the value, the better the insulating material. A comparison of such values is as follows (15):

	Lbs./Cu. Ft.	"K" Value
Glass wool	4	.26
Rock wool	6	.27
Cork board	7	.28
Fiber board	18	.34
Hair felt	9	.26
Phenolic resin foam	2	.24

For insulation construction these foams are poured in as liquids and allowed to expand. Thus, forming in place, they fill the walls of a cabinet with a rigid, lightweight, non-settling, porous mass of high insulating value—a mass which further contributes to the strength of the entire structure, as in the above described "sandwich construction."

Continuous Contact Pressure Laminating

During the war considerable contact-pressure Fiberglas - styrene - polyester laminated was required for aero gas tank lining and other purposes (16). In order to speed production a method was developed for continuous manufacture of such laminated flat sheets. Today with varicolored or printed top sheets these contact pressure laminates are being offered for wall coverings and for surface sheets for plywood.

Laminated Surfaced Plywood

As an expansion of the resin impregnated plywood surfacing used during the war for packaging, there is a considerable development in this for constructional, decorational, and packaging fields. Phenolic resin impregnated paper applied to resin-bonded plywood forms a tough waterproof skin. The laminate and the plywood may be bonded in one operation. This surfacing eliminates many objections to Douglas fir plywood, reducing surface checking and grain-raising, and offering a better surface for painting when required. The surface sheet may be smooth or embossed to give many architectural finishes.

Postforming of Laminates

Current practice is utilizing more and more the forming of shaped and drawn parts from laminated stock in relatively inexpensive molds. This again is the continuation of war experience, particularly that gained in "formed" aircraft parts. An example here shown is the P-51-D airplane's ammunition ejection chute (Figure 3). This replaced a metal chute at approximately one-half the weight and at a reduction in assembling time from over one hour to 15 minutes. Also saved was the spot welding of four individual pieces to complete the part. Owing to its acceptance in the aircraft field for semi-structural and non-structural parts, a growing peacetime use is indicated. Added to its properties of strength plus light weight, is the ability to form from flat sheets many complex and large shapes from inexpensive molds. These operations were recently presented by Bruce Nash (17).

Cold-Setting Resin Glues

Progress continues in the development of high strength water-resistant and weather-resistant glues for plywood and the bonding of wood structures. A recent advance is the perfecting of phenolic-resinoid glues which are cold-setting and at the same time provide maximum water resistance and durability. Not only is it possible to omit the former heat-curing operation, but, because of higher specific adhesion, many types of wood may be bonded at contact pressure.

New Synthetic Resins

Research on synthetic resins is one of the most prominent fields in organic chemistry today. In a short review such as this it is impossible, and perhaps unnecessary, to cover the trend in resin research. Also many changes in resin composition and manufacturing technique are continually introduced into standard lines of products, with publicity emphasis given only to final differences in product performance. Among recent new products which are significant, or others which are of development interest, may be mentioned:

Polyethylene

Developed to meet urgent insulation requirements, polyethylene went into commercial production in 1943. It was used almost exclusively for insulation of high-frequency wire and cable. It stands today as the material enabling us to take full advantage of developments in electronics, setting new standards in insulation of high-frequency applications. Its additional characteristics of flexibility and toughness over a wide temperature range, its low water absorption, and its impermeability to moisture, together with its chemical inertness, emphasize its use in containers, gaskets, battery parts, packaging films, chemical equipment, flexible tubing.

Styrene

The excellent molding and insulation properties of polystyrene known in recent years were extended by the application of the monomer in the contact pressure laminates mentioned previously. The 400-million-pound plant capacity developed for synthetic rubber needs presents an impressive potential raw material source. In addition there are now available, or in the development stage, several copolymers with other hydrocarbon and nitrogen base resins, as well as halogen derivations which offer improved physical properties for certain uses. As an example, higher heat distortion temperatures may be secured. Also the availability of polystyrene base materials in foamed resins, and in the form of matted highly oriented fibers for low-pressure bag molding, add further industrial uses. Before the advent of such fiber mats, thermoplastics were not readily bag molded.

Organo-Silicon Polymers (Silicones)

A recent development in a novel-type combination of inorganic-organic polymer is finding many new fields of usefulness. The silicon atoms carry one or more hydrocarbon groups joined to the silicon through carbon atoms (18). Typified by unusual heat-resistance and excellent electrical insulation properties, Silicones are being utilized to reduce the size and weight of electrical equipment—for example, electric motors. Their liquid varieties have been found to show little change in viscosity over large temperature variations. In spite of the fact that before the war these resins were only laboratory curiosities, their unique properties are today receiving close attention for many engineering and technical applications.

Vinyl Resins

This group of elastomeric compounds (19) were widely used in the war in a multiplicity of services which pointed to today's extensive development in civilian and industrial products. They include the vinyl chloride-acetates (rigid and non-rigid), polyvinyl butyral, polyvinyl chloride, and vinylidene chloride polymers. Their production last year (1944) showed a 440% increase over 1941, which was essentially in vinyl chloride-acetate polymer. This was largely used in flexible film material and in Navy cable insulation. The extent of the latter use is emphasized when we learn that the new plane carrier *Franklin D. Roosevelt* contains 2,272 miles of insulated, non-flammable, electrical cable.



Fig. 3. An example of postforming of laminates is this ammunition ejector chute for the P-51-D airplane

The large use of vinyl polymers during the war for coating textile raincoats, etc., has led to recent new products in which the vinyl chloride-acetate resins are of the suspension or dispersion type (20) which do not require the use of active solvents in the thinner. One class is offered as flexible textile coatings, another as a dispersion type for protective coatings and for molding. Another type of vinylidene chloride as a latex has been described recently (21).

Melamine

Formaldehyde resins prepared from this trimer of cyanamide supplied an important war function in arc-resistant molding materials and in special laminated products. It has extended its use in paper treatment for wet-strength, in textile treatment, and in hot-setting plywood glues. Its properties and its expanding uses place it in the field of recent significant developments.

Allyl Resins

First introduced in 1942, esters such as maleates, phthalates, etc., derived from allyl alcohol or allyl chloride have had some use in contact pressure laminates. They represent a class of thermohardening materials cured by addition-polymerization, a combination of properties somewhat between thermosetting and thermoplastic materials. Because of their interesting properties in laminates and castings, their further development is indicated.

Cellulose Base Plastics

Cellulose acetate and aceto-butyrate both as molding materials and films played important parts in the war effort. They are rated as strategic plastics, but are playing an even greater role in civilian usage. A new development, recently announced (22), is cellulose propionate. In addition to improving cellulosic molding materials, especially in impact, moisture sensitivity, and flow characteristics, it is expected to have advantages over cellulose acetate film and sheet.



Fig. 4. Shoe soles of vinyl plastic sheeting are long wearing. Plastic sheeting has introduced new design possibilities to footwear since uppers and soles can now be produced in contrasting or matching colors

New Tools in Synthetic Resin Development

Considerable progress is being made with the adoption to resin research of such new tools as infrared and ultraviolet absorption spectra, X-ray diffraction patterns (23) and the use of the electron microscope. With these measurements we are gaining a better insight into the structure of resins, the absorption bands indicating organic groups, double bonds, and branching.

Emulsion polymerization has been greatly aided by our experience gained in rubber synthesis of the styrene-butadiene type. Certain advantages over bulk or mass polymerization have been developed. Among these are: finer suspension of reacting particles; homogeneity throughout the reaction; ease of catalyst dispersion and simpler control. More recently the suspension technique (or "pearl polymerization") has shown advantages in freedom from emulsifying agents and other impurities (24).

Another tool that may prove of practical interest is the application of ultrasonics. Dr. H. Mark (25) shows that ultrasonic waves of 100 to 1000 microns can produce or destroy colloidal suspension, break Van der Waals' bonds, or destroy primary chemical bonds. Permanent decrease in viscosity of solutions of polystyrene, cellulose nitrate, polyvinyl-acetate by ultrasonic waves illustrates the destruction of primary valence bonds.

Some New-Use Products of Standard Resins

Many new-use products are appearing today, based on the experience gained during the war for other purposes. This statement is especially true in the field of flexible and rigid elastomeric compounds. With this wartime experience in new plasticizers and production methods on vinyl resins, we are offered an impressive list of civilian materials. These include washable upholstery for furniture and open automobiles, draperies, shower curtains, raincoats, and many articles of clothing, shoe soles and uppers which far outlast the products they displace. It is interesting to note that a recent six month's survey shows over 2,941,000 pairs of vinyl resin soles marketed with satisfactory consumer acceptance. (See Figure 4.) Other developments have been in plastic film and sheeting, where both heat-sealing and high-frequency welding have speeded their usefulness in packaging and other fields. Recently announced, the flexible, non-shatterable phonograph record made of vinyl resin also gives clearer and more natural tonal qualities. Vinyl resin printing plates cast from phenolic matrix proved successful during the war in saving metal, in light weight for shipping by air, and in simplifying operations. The plates weigh only one pound per page compared with eight pounds for comparable electrotypes. They are expected to play an even greater part in civilian life (26).

The elastomeric plastics of the non-rigid types are appearing as distributer cap nipples, grommets, valve seats, seals for holes, vibration dampers, and shock absorbers (27). Their civilian usage appears limitless.

The methyl methacrylate resins, such as Lucite and Plexiglas, which played such an important, as well as a picturesque, part in World War II, are expanding into much larger civilian and industrial usage. These glass-clear materials were used for cockpit, gun turret, and helicopter nose canopies, landing light covers, aircraft glazing, and numerous other uses. Their advantages as transparent civilian materials are too well known to be emphasized further. A recent release by O.S.R.D. (28) announces the large production of optical lenses, prisms, etc., made from either polycyclic-methacrylate resin or from polystyrene.

Molded plywood and low-pressure molded high-strength laminates used during the war as the material for PT boats, Mosquito planes, trainers and gliders are today appearing as molded boats, lightweight luggage, automotive body parts, and similar uses.

Another recent development in newer uses of standard plastics material is the application of phenolic resin coatings to metal by means of induction heating (29). This application especially to steel pipes and tubing was recently outlined (30) as it applied to pipe lines for petroleum and natural gas, as well as boiler tubes, heat-exchanger tubes, etc.

Advances in Molding Equipment and Methods

In the last analysis plastics research may be considered the hand-maiden to the engineer. New materials are offered to be fabricated and engineered. The recent year has shown some significant developments in molding equipment. Among these may be noted:

High-speed plunger molding (31) offers a mechanism to injection mold successfully thermosetting materials at a very fast rate of speed and with the use of radio frequency (heatronic) heating to preheat the preforms. This type of machine is speedy and is attracting considerable interest.

The adoption of injection and extrusion molding to thermosetting (phenolic) molding material to give continuous extrusion (32) utilizes a multi-purpose molding machine using a motor driven screw, from which may be molded long lengths of phenolic plastic pipes or tubes.

Another recent advance is in the frictional welding of thermoplastics described by R. N. Freres (33).

Screw extrusion of vinyl resins has been used for thermoplastic wire and cable insulation. A successful method is described by W. F. Hemperly (34).

One of the high costs in the molding of plastics has been the fine machining necessary to prepare special steel dies. It may be that work now proceeding on the precision casting of steel may greatly reduce costs for certain requirements. Also a recent article (35) on manufacturing hydraulic molding presses by welding may facilitate the fabrication of such pieces over the conventional methods.

Conclusion

In a paper for presentation within the time limit of this session it is manifestly impossible to cover the complete field of plastics. The title could well have been "*Some* Recent Developments," since many individual plastics, as well as certain entire fields of usefulness, were not mentioned. Many of these are brought to you in the display of plastics materials presented here in the room.

The bibliography attached covers those papers referred to in this discussion. It is expected that the useful review of the complete plastics literature for 1945 will be presented as usual (36) by Gordon M. Kline in the January, 1946, issue of "*Modern Plastics*."

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Billion-Dollar Industry[1]

THE plastics industry has emerged from the war with enormous possibilities that may some day make it another billion-dollar industry. Authorities believe that the secrets of 20 normal years of scientific progress have been uncovered by the plastics industry during the past five years of war effort. While plastics research and production were increasing steadily under their own momentum in the 1930's, the war years have increased the total dollar volume of plastics produced since 1939 by 325%, with an additional growth of 20-25% foreseen in the predictable future. The present annual volume is about $300,000,000.

American plastics manufacturers have introduced more than 15 types of plastics since 1929, as contrasted to the pre-1929 rate of about one every 20 years. Among the reasons for this amazing expansion are the well-organized research programs that have been instituted and the valuable mechanical contributions made toward the fabrication of plastic articles.

More than a score of plastics are now in commercial production for application in the automotive, aviation, decorative, and novelty fields, to mention but a few of the major outlets for plastics. The building industry also looms as an important new user of plastics, as does the fast-developing television field. Other industries are expected to become large users of plastics as complete redesigning comes about.

[1] From "A Billion Dollar Industry in the Making" by the plastics department, E. I. du Pont de Nemours & Co., Inc., in **The Royle Forum**, Dec. 15, 1945, p. 4, published by John Royle & Sons, Paterson, N. J.

Materials Supply Outlook for 1946 and 1947[1]

AUTHENTIC estimates of the current, immediate future, and long-range availability of plastic materials are now possible on the basis of an extensive survey of the members of the Plastics Materials Manufacturers' Association. One of the most important phases of the supply picture is the expansion programs being undertaken by many material manufacturers. A conservative estimate of the plans of the Association members alone is that new facilities for plastic materials production will entail expenditures amounting to 102 million dollars during 1946 and the early part of 1947. Barring unforeseen delays, many of the expansion programs will become effective in this spring and thereafter through the middle of 1947.

One of the most disturbing factors in the current supply situation is the availability of labor, which is extremely critical in the East and New England. Manufacturers of phenolic molding materials are being severely hampered by the shortage of wood flour due to labor difficulties in the lumber industry and to insufficient conversion. It is hoped that improved labor conditions and possible resumption of wood flour imports from the Scandinavian countries will relieve this shortage. A strike in the steel industry would slow down coking ovens, thus curtailing tar acids sup-

Other material shortages are insufficient supplies of cellulose acetate flake, for which ample expansion of facilities is now going forward; critical supply of cotton waste, which could restrict production of impact materials; and possible uncertain supplies of coloring pigments for styrene molding materials when the large expansion of this plastic becomes effective.

Reports to the Association indicate the following outlook for various types of plastic materials:

PHENOLIC MOLDING MATERIALS. Curtailed by the shortage of labor and wood flour, producers are operating at about 70% of capacity. Assuming availability of labor and wood flour early this year, it is estimated that new facilities will allow about a 16% increased material supply, based on present capacity. Expansion of facilities now pending or already started will permit an approximate 42% increase over present capacities during early 1946.

UREA AND MELAMINE MOLDING MATERIALS. Current production is more than 90% of total capacity. It is expected that new facilities and additional labor, together with the resumption of production by an additional manufacturer, will effect a 25% increase over present output starting in April. Announced expansions to become effective during the latter part of 1946, or early 1947, will permit an 80% increase above current production.

THERMOPLASTIC MOLDING MATERIALS. The shortage of these materials has been fairly acute, but a 33% gain in output is anticipated during the first quarter of 1946. Expansions pending and under way will bring additional capacity during the year, and by the second quarter next year an increase of about 150% over current levels is expected. Production of cellulose ester molding materials should increase 6-10% in the first quarter of 1946, and expansion will provide a 53% increase by July, 1947. New facilities for polystyrene molding powder should provide a rise of 135% in output during the early part of 1946, and an ultimate increase of 600% by long-range expansion. There should be a 20% increase in production of acrylic molding powder during the first quarter this year, and long-range expansions are believed adequate for all foreseen demands. Expansions in the production of ethyl cellulose molding materials are already becoming effective, and should further increase availability by 13% in the early part of 1946 and by 36% in the first quarter of 1947. The present capacity of polythene and nylon molding materials is sufficient to meet demand, and enlarged capacities will be available during the first quarter of 1947.

POLYVINYL CHLORIDE AND COPOLYMER RESINS. Shortage of labor is holding production of the compounding plants at about 70% of capacity. Over the long term it is anticipated that compounding capacity will be upped about 100%, which should take care of requirements.

POLYVINYL BUTYRAL SHEET. Present demand is abnormally low due to strikes. Capacity appears sufficient to meet normal demand.

VINYLIDENE CHLORIDE RESINS AND PLASTIC. Substantial increases have already been effected, and production should soon double the 1944 rate. In the early part of 1947, output will be about 450% of the 1944 rate.

CELLULOSE NITRATE SHEET, ROD, AND TUBE. Capacity operation is on at present, with demand somewhat in excess of supply. Flake production is now 50% more than that of 1944, and a slight increase is anticipated early in 1947.

CELLULOSE ACETATE SHEET, ROD, AND TUBE. Capacity operation is reported at present. No forecast is made for increased production of film during the first quarter this year. Increased availability of continuous sheeting is anticipated the latter part of 1946 and through July, 1947, amounting to a 66% rise over the present rate.

ADHESIVES, LAMINATING AND SPECIALTY MATERIALS. There has been a marked drop in demand for urea and melamine resins for adhesives, and production facilities appear adequate. Some expansion will come into operation during the current first quarter. Availability of laminating materials is adequate at present. Cast phenolics for certain end uses, such as radio cabinets, are below demand, and a moderate expansion can be expected. Requirements for the various phenolic liquid resins are being met without undue difficulty at the present time.

METHYL METHACRYLATE CAST SHEET. The supply exceeds demand, and customers' requirements are being filled.

With some exceptions, the demands for plastic materials greatly exceed the supply at this time. It is evident that some measure of relief will become effective during the first quarter of 1946 and will continue thereafter with substantial increases in availability effective late in the year. Expansions pending and under way should cover foreseen increases in demand.

[1] Abstracted from article by F. H. Carman, general manager, Plastics Materials Manufacturers' Association, dated Dec. 21, 1945.

Fire Hazards with Plastics

SPEAKING at a meeting of the Fire Chiefs Club of Massachusetts in conjunction with the New England Association of Fire Chiefs, at the Copley-Plaza, Boston, Mass., on January 16, Foster D. Snell, president of Foster D. Snell, Inc., Brooklyn, N. Y., said that the new plastics and chemicals world is bringing increased safety to individuals and property, and some of the fears expressed by fire fighting authorities and public safety administrators are completely unfounded.

These new products, Dr. Snell said, are decomposed by burning into the same materials as the old products dealt with by fire fighters. In many cases the new products, plastics or solvents as examples, are less of a fire hazard than the more familiar products they supersede. Citing melamine resin as an old substance being widely appiled in new uses, Dr. Snell asserted that this substance is no more dangerous in the home than wood or paper. In burning, it behaves like other nitrogenous materials, such as leather, wool, steak, and milk solids.

Defending new solvents, Dr. Snell explained they are not highly toxic. The dangerous ones are the old ones with familiar names like nitrobenzene, naphtha, and gasoline, which will burn and explode when mixed with proper proportions of air.

Burning a nitrogenous material without a substantial excess of air will cause some formation of cyanide gas, particularly feared by fire fighters. There are quite a number of materials which, on the basis of U. S. Public Health Service standards, are more dangerous than cyanide, Dr. Snell stated. The three most dangerous gases are arsine, chlorine, and ozone, of which only chlorine can exist in the presence of fire. Chlorine, however, because of its odor, is its own indicator and gives sufficient notice before reaching dangerous concentrations.

Lustron Production Expands

THE plastics division of Monsanto Chemical Co., St. Louis, Mo., has announced that starting the first of this year Lustron is being sold at a base price of 25¢ per pound for crystal in carload quantities; whereas it previously had been available only in limited quantities. The premium grade of Lustron developed during the war is being dropped, and capacity devoted to regular Lustron at standard price levels.

The combination in Lustron of optical clarity, extremely high resistance to chemical attack, light weight, and excellent electrical properties recommends it for most injection molding applications. Since its introduction in 1938, it has found wide acceptance for use in refrigerators, radios, household goods, packaging, lighting, and many other consumer and industrial applications.

In announcing the new production, Monsanto also expressed a belief that polystyrene will become the most important general-purpose thermoplastic molding material as soon as planned production facilities are in operation.

CALENDAR

Feb. 1.	Akron Rubber Group. Mayflower Hotel, Akron, O.
Feb. 1-2.	Low-Pressure Industries Division, Society of Plastics Industry, Inc. Edgewater Beach Hotel, Chicago, Ill.
Feb. 3-8.	National Sporting Goods Association. 1946 Convention. Hotel New Yorker, New York, N. Y.
Feb 5.	Los Angeles Rubber Group, Inc. Mayfair Hotel, Los Angeles, Calif.
Feb. 15.	Connecticut Rubber Group. Public Library, Bridgeport, Conn.
Feb. 25-Mar. 1.	A.S.T.M. Spring Meeting. Hotel William Penn, Pittsburgh, Pa.
Feb. 25-Mar. 2.	Twentieth Exposition of Chemical Industries. Grand Central Palace, New York, N. Y.
Mar. 5.	Los Angeles Rubber Group, Inc. Mayfair Hotel, Los Angeles, Calif.
Mar. 8.	Boston Rubber Group. Copley Plaza Hotel, Boston, Mass.
Mar. 16-24.	Fourth Annual Southwest Sportsmen's Show. Municipal Auditorium, St. Louis, Mo.
Mar. 20-22.	Chicago Technical Societies Council. Chicago Production Show and Fourth Annual Conference. Stevens Hotel, Chicago.
Apr. 2.	Los Angeles Rubber Group, Inc. Mayfair Hotel, Los Angeles, Calif.
Apr. 2-5.	Packaging Exposition. Public Auditorium, Atlantic City, N. J.
Apr. 8-12.	American Chemical Society. Atlantic City, N. J.
Apr. 22-27.	Society of Plastics Industry. National Plastics Exposition. Grand Central Palace, New York, N. Y.
Apr. 27-May 18.	International Products of Tomorrow Exposition. Chicago Coliseum, Chicago, Ill.

Plastics Association Elections

W. STUART LANDES, vice president of Celanese Corp of America, and John R. Hoover, vice president of B. F. Goodrich Chemical Co., were reelected president and vice president, respectively, by the Plastic Materials Manufacturers Association, Inc., at the annual meeting on January 10 in New York, N. Y. Frank H. Carman was reelected general manager, and John E. Walker secretary-treasurer of the Association, with headquarters in Washington, D. C.

A seven-man board of directors was named which will include, in addition to Messrs. Landes and Hoover, two directors held over from the 1945 board, James L. Rodgers, Jr., vice president of Libbey-Owens-Ford Glass Co., and D. S. Frederick, vice president of Rohm & Haas Co. New members of the board are Harry Krehbiel, president of Catalin Corp., M. G. Milliken, vice president of Hercules Powder Co., and Felix N. Williams, vice president of Monsanto Chemical Co. Arnold E. Pitches, general manager of the plastics department of E. I. du Pont de Nemours & Co., Inc., and past president of the Association, will serve in an advisory capacity to the board of directors in accordance with the by-laws.

The resins and adhesives division of P. M. M. A., meeting on January 9, elected Louis Klein, vice president of Resinous Products & Chemical Co., as its chairman.

National Plastics Exposition

THE present status of all the plastics and their tremendous possibilities for future application in all types of industries will be presented graphically in the first National Plastics Exposition, to be held in Grand Central Palace, New York, N. Y., April 22 to 27, under the sponsorship of the Society of the Plastics Industry, 295 Madison Ave., New York. Some 200 companies will participate. Attendance will be drawn not only from all parts of the United States, but also from Canada, Latin America, and Europe. Concurrently with the exposition, the SPI will hold a convention at which leading authorities will tell about the latest advances in plastics technology and application.

Anticipating a large out-of-town attendance, the Society is organizing a special housing bureau, to be run by the New York Convention and Visitors Bureau, to assure adequate hotel accommodations.

To permit thorough study of the exhibits by representatives from industry, the general public will be admitted to the exposition only on the last three days of its showing. Business men are therefore requested to time their visits during its first three days, April 22 to 24, inclusive, when technical experts of the participating companies will be in a better position to provide individual information and consultation. According to Ronald Kinnear, chairman of the SPI exposition committee, the exhibition will present the basic plastics materials, the machinery to fashion them into products, the methods and services for so doing, and the products themselves—all together under one roof at the same time. The manufacturer will be enabled to make direct comparison of the qualities, characteristics, and specific functions of all the plastic materials, equipment, machinery, and services.

GE's 1945 Developments[1]

RUBBER: In the tire industry where line-shaft drive was previously the conventional type, a complete electric sectional drive was introduced for a 32- by 70-inch four-roll calender with processing auxiliaries. One advantage of the new drive will be that measurements and control of tension throughout the calender processing line are possible.

SILICONES: Silicone rubber attained prominence during the year as a high-temperature electrical insulation. Production was on a pilot-plant scale, but the material was made available for special applications requiring chemical inertness and ability to withstand temperatures of nearly 400° F. Silicone resins were developed that, while closely resembling conventional resins in physical appearance, have higher thermal stability, improved dielectric properties, and greater mechanical strength and toughness.

PLASTICS: An adjustable-voltage drive is to be used for a calender that

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[1] From "Electrical and Allied Developments of 1945," G. Bartlett. **General Electric Review**, Jan., 1946.

RUBBER WORLD NEWS of the MONTH

Highlights—

Although the scheduled three-day public hearings by the OWMR Inter-Agency Committee on Rubber produced only three witnesses and lasted only half a day, W. L. Batt, the committee chairman, announced that many briefs and statements had been filed with the committee by persons interested in the formulation of our national policy on rubber. The committee's report to the President and Congress is expected during February. The Surplus Property Administration submitted an interim report on disposal of the synthetic rubber plants to Congress, but stated that surplus declaration of these plants awaited establishment of a national rubber policy. Details on the disposal of additional rubber goods manufacturing plants were disclosed. A few more reports on the Far Eastern rubber situation were made public. Although strikes in many basic industries threatened to paralyze partially the nation's industrial activity, industrial relations in the rubber industry in January were generally improved.

National Rubber Policy and Plant Disposal

Only three witnesses appeared before the Inter-Agency Committee on Rubber at the public hearing in Washington, D. C., on January 8. Two of these witnesses were representatives of the United Rubber Workers of America (CIO) andt he other was a tire dealer. All spoke in favor of continued production of synthetic rubber. The SPA report to Congress on the disposal of synthetic rubber plants suggested the possibility of early disposal of government plants for producing Butyl and neoprene and butadiene from alcohol, but indicated a desire to await the Batt committee report on national policy, before making definite decisions. Two government sole and heel plants were offered for sale.

Public Hearings by Policy Committee

The three-day hearings on rubber requirements and supply closed after a single morning session on January 8, with William L. Batt, chairman of the OWMR Inter-Agency Policy Committee on Rubber, expressing "surprise and a little disappointment" over the small turn out of witnesses. Despite the considerable advance publicity announcing the public hearings, only three witnesses appeared before the committee. Much outside interest in the hearing was apparent, however, since the hearing room in the Social Security Building was packed with spectators, mostly tire dealers.

Although before the hearing the plan was to have witnesses submit their names before testifying, Chairman Batt finally called on "anyone here" to make a statement or ask questions of the few witnesses who appeared. Even this request brought only one response from the floor. The chairman then explained that the meager response did not indicate lack of interest, since the committee had conferred with many representative groups, and briefs and suggestions had been received by the committee.

First witness to appear was A. L. Lewis, director of research of the URWA. Dr. Lewis told the committee he had expected to answer questions and had not prepared a formal statement. He also stated that his remarks were his own opinions since the union had not passed on any specific recommendations.

"We are principally interested," he said, "in the future security of our members in the rubber industry. This interest lies in continuity of employment and working conditions. Continuity of employment depends on the continuous supply of raw materials, and therefore we are interested in the future of synthetic rubber. We want continued operation of synthetic plants —to a degree; what degree we are not prepared to say. We don't want to be placed in a position similar to that at the beginning of the war. Continuous operation of synthetic rubber plants will help bring about uniform price of rubber. When raw material prices are high, labor is affected. If prices are high, production costs might be trimmed, and this might hit labor."

The labor leader reviewed the early days of the production of synthetic rubber, when workers met many unsatisfactory conditions, particularly with regard to health. He said, however, that working conditions have "greatly improved" and such conditions that remain are "correctable."

"We feel," he stated, "that the peoples' investment of $700,000,000 should be adequately protected. As to the manner of the protection, we have not resolved the question."

Dr. Lewis praised the work of the Division of Standards of the Department of Labor and said the Division's watching of health conditions in the synthetic rubber industry has been "highly beneficial."

Chairman Batt thanked Dr. Lewis for his "very mature view" and explained that poor working conditions at the beginning of the synthetic rubber program were largely due to the development of a new industry, and most of these conditions have been largely corrected.

Answering a question from the floor by James R. Connor, representing the National Association of Independent Tire Dealers, Dr. Lewis said:

"It is beyond the province of the United Rubber Workers to say what the final disposition of the synthetic rubber plants should be. Organized labor, however, would deeply resent turning the plants over to private interests at a substantial decrease from their original cost—except that for depreciation and obsolescence."

The chairman interposed to say that there was still considerable uncertainty as to the disposal of the synthetic plants until the future market for synthetic rubber is better known.

"We want to know whether or not the public will want synthetic rubber in peacetime in competition with natural rubber. This is a very serious question. Nobody knows what the price of natural rubber will be when it comes back. There is no clear answer today. There are too many variables."

T. R. Owens, also of the United Rubber Workers, testified briefly, stating that he was in accord with Dr. Lewis' statement and added that he thought the reaction of consumers should be obtained.

The chairman replied that he had hoped that some consumer organizations would appear at the hearings.

Final witness was George J. Burger, of the Burger Tire Consultant Service, New York, N. Y. He called for some sort of regulation to be set up by the industry or the government to make sure that full use would be made of synthetic tires. He said his experience and that of other tire dealers had shown that the synthetic passenger-car tire had given satisfactory performance, and although there was some difference of opinion on truck and bus tires, they, too, had given satisfactory performance in the majority of cases.

"Tire retreaders tell me," he said, "that each shipment of synthetic tires is better than the preceding."

With the exception of Chairman Batt, no other member of the committee made a statement or asked any questions of the witnesses.

Just prior to the hearing, the National Association of Independent Tire Dealers submitted a statement to the committee, part of the text of which follows:

"From the welter of confusing reports on the nation's synthetic rubber program and world rubber supply, the people of the United States and their elected servants in Congress must soon make a decision to operate or abandon all or part of the synthetic plants. . . . "There was the authorized expenditure of $719,000,000 for synthetic plants during the war. Despite bombastic advertising of some manufacturers this represented a 99% expansion of former synthetic plants, and the government (meaning each one of us and our tax money) financed $676,000,000 of the total. This might lead to the misunderstanding that the $43,000,000 of private financing was for complete privately owned synthetic plants. This is incorrect. Not one of the 49 synthetic plants was wholly financed by private capital. Thirty-seven of the plants were government financed. This means that with a $43,000,000 investment (some of which may have been in the form of direct or indirect government loans), or less than 6% of the entire $719,000,000 investment, private operators were able to share in ownership of 24% of the

plants, and these plants of mixed ownership were valued at $158,000,000, while the wholly owned government plants were valued at $513,000,000. All the plants were privately operated.

"Full operation of the plants would provide work for 23,000 people. Your Washington office makes no suggestions regarding these vast investments of your money, but we shall be glad to hear any suggestions from members on their individual views."

The report on national rubber policy is expected to be presented by the Batt committee through OWMR Director Snyder to President Truman, who in turn will present it to Congress for legislative action, some time during February.

Disposal of Synthetic Plants

The Surplus Property Administration, in an interim report to Congress on January 14, explained why it was not possible to make a complete report at that time since none of the synthetic rubber plants has been declared surplus and certain other factors make their surplus declaration indefinite. The SPA stated that it agreed with a decision of the RFC, the owning agency, not to declare the synthetic rubber plants generally surplus until after a national rubber policy has taken specific form, but at the same time expressed the belief that certain plants not closely connected with national defense might well be made available for disposal at an early date. Reference was made to that fact that the Inter-Agency Policy Committee on Rubber of the Office of War Mobilization and Reconversion, in which the SPA is represented, is expected shortly to report its findings and recommendations to the President and Congress.

In a section of the SPA report entitled "Problems of Policy" it was pointed out that the outcome of free competition between natural and synthetic rubbers during the next few years, except for neoprene and Butyl, is by no means certain. There is substantial difference of opinion concerning the future prospects for GR-S or general-purpose rubber, it was said. There are those who believe that it might retain a considerable place in the market in free competition with natural rubber on a price and quality basis, while others are of the view that little, if any, of the industry can survive without continued government support.

In the short run (i.e., until natural rubber is in ample supply) the maintenance of synthetic rubber output at a substantial level is not likely to present difficulty, the report said, since in view of prospective requirements by the United States for perhaps 900,000 tons of rubber of all types, the demand for synthetic in 1946 will considerably exceed any minimum likely to be prescribed for national defense.

With regard to comparative price and quality, on a competitive basis, synthetic rubber must be priced sufficiently below natural rubber or corresponding quality to offset the higher processing costs. Generally speaking, manufacturers of tires seem willing to use nearly 100% GR-S for the production of the smaller sizes, but are eager to increase their use of natural rubber as much as possible for the production of heavy truck tires and would probably do so if supplies were available, even if it were necessary to pay a price premium, the SPA report added.

The continuation of research by the government on synthetic rubber and its use was urged, and it was also pointed out that the framing of policy with respect to synthetic rubber cannot be based on strictly economic considerations, but must include the problem of national defense. The decision as to the amount of synthetic rubber capacity to retain for national defense purposes depends in part upon the size of the stock pile of natural rubber to be held, since there exists an inverse relation between the two; but decisions on such points, and the means for giving them effect, do not lie within the discretion or responsibility of the SPA, it was added.

Early disposal of plants for producing Butyl and neoprene, as well as some of the plants for making butadiene from alcohol, and plants, which by virtue of their location or characteristics, do not seem to have much chance of being retained in the national defense program, was suggested as a possibility, but the SPA indicated that it had accepted the decision of the RFC not to make these partial decisions until the future national rubber policy and program have been formulated. As soon as the overall policy has been decided upon, the SPA will arrange for the disposal of plants to be declared surplus.

This SPA report also contains detailed information on all of the synthetic rubber plants owned by the RFC, with special reference to the source of raw materials, power, and transportation facilities, locations and operators, and the extent of private ownership of some parts of the facilities of certain plants.

Disposal of Other Plants

The rubber sole and heel plant formerly operated by the Plymouth Rubber Co., Canton, Mass., was offered for sale or lease by RFC on January 10. This plant, originally estimated to have cost $600,000, consists of a one-story reenforced concrete and brick building with 25,000 square feet of floor space and a partial list of available equipment including a No. 11 Banbury mixer, a Stuart Bolling mixing mill, and a York refrigerator system.

Another sole and heel plant that was designed and built, but never got into production at Chelsea, Mass., was offered for sale or lease by RFC on January 11. The building, which has an available floor area of 122,280 square feet, is constructed with steel frame, brick walls, and concrete floors and contains various pieces of equipment, such as two Banbury mixers, eleven mills, seven hydraulic presses, four hot-plate presses, three conveyers, and a dust collector system. A 600-foot railroad siding, within 160 feet of the building and owned by the Panther-Panco Rubber Co., connects with the Boston & Maine Railroad. Airport and dock facilities are similarly convenient to the property, operation of which was intended to be conducted by Panther-Panco.

Sale of the partially completed tire plant at Tuscaloosa, Ala., to The B. F. Goodrich Co. for $3,966,000 has been reported as approved by the RFC, but is awaiting approval of the SPA and the Attorney General. Originally the plant was scheduled as a $18,000,000 project, and the Defense Plant Corp. spent $7,127,256 on the plant before construction was halted last July. The RFC stated that Goodrich plans to turn out 5,000 passenger car tires daily at this plant.

Last month, in connection with the announcement that the RFC had tentatively approved the sale of various tire and other-type plants to different companies, such as the tire plant at Topeka, Kan., to Goodyear Tire & Rubber Co., the tire plant at Natchez, Miss., to Armstrong Tire & Rubber Co., and part of the tire facilities at Waco, Tex., to General Tire & Rubber Co., the indicated sales price was given as the same as the cost of these plants owing to an error in interpreting the RFC announcement. The War Assets Corp. on January 20 announced the sale of the Topeka tire plant to Goodyear for $5,669,269; the total cost of this plant was $7,961,533. No information is as yet available on the actual sales price of the Natchez tire plant listed as costing $1,050,000, or the part of the tire producing facilities at Waco, which cost $447,290.

RMA on Textiles, Soles and Heels, and Tires

Warren S. Lockwood, executive vice president of The Rubber Manufacturers Association, Inc., New York, N. Y., spoke before the Cotton-Textile Institute at its annual meeting in New York November 28 on "The Rubber Manufacturing Industry's Report to the Cotton Industry," and Mr. Lockwood also spoke at a meeting of the Metropolitan Leather & Shoe Finders Association in New York, January 11, on "The Rubber Heel and Sole Industry's Postwar Future." Since these talks contained significant points on the current thinking of the rubber industry in these fields, portions of both of these talks are given below.

With regard to the cotton price picture, attention was called to the fact that based on the simple law of supply and demand, cotton is artifically high in price and has been so for a number of years. It was pointed out that if this "umbrella" is held over synthetic fibers long enough, they will become so well established that even reduction in the price of cotton will not make it easy for cotton to regain its position.

Consumption figures for textiles by the rubber industry during 1945 were quoted. Exclusive of cotton and rayon tire cord, where for the period July, 1944, to July, 1945, approximately 170,000,000 pounds of rayon tire cord and 221,000,000 pounds of cotton tire cord were produced; the rubber coating section of the industry estimated that 78,000,000 yards of all types of cotton textiles were consumed in 1945 for essential civilian uses; the footwear section of the industry estimated

ESTIMATED AUTOMOTIVE PNEUMATIC CASING AND TUBE SHIPMENTS, PRODUCTION, AND INVENTORY—NOVEMBER, 1945—FIRST 11 MONTHS 1945-1941

	Original Equipment	Replacement			Total Shipments	Production During Month	Inventory End of Month
		War Orders	Civilian	Export			
Passenger Casings							
November, 1945	341,536	1,466	3,113,702	24,864	3,481,568	3,683,522	
October, 1945	173,374	840	3,057,558	20,156	3,251,928	3,627,221	1,671,932
First 11 mos., 1945	886,661	128,783	22,167,292	183,684	23,361,420	24,355,933	1,837,516
First 11 mos., 1941	19,097,423		33,105,070	576,502	52,778,995	48,492,358	3,015,207
Truck and Bus Casings							
November, 1945	294,396	6,579	666,856	33,050	1,000,881	989,695	
October, 1945	276,560	22,049	785,638	33,063	1,117,310	1,072,711	679,689
First 11 mos., 1945	4,718,031	4,589,434	5,779,007	249,127	15,335,599	15,320,159	677,014
First 11 mos., 1941	4,393,803		5,511,399	875,556	10,780,758	10,078,190	1,027,788
Total Casings							
November, 1945	635,932	8,045	3,780,558	57,914	4,482,449	4,673,217	
October, 1945	449,934	22,889	3,843,196	53,219	4,369,238	4,699,932	2,351,621
First 11 mos., 1945	5,604,692	4,718,217	27,946,299	432,811	38,697,019	39,676,092	2,514,530
First 11 mos., 1941	23,491,226		38,616,469	1,452,058	63,559,753	58,570,548	4,042,995
Passenger Truck and Bus Tubes							
November, 1945	667,279	10,609	3,297,643	47,068	4,022,599	4,245,000	
October, 1945	469,512	31,975	3,375,761	47,083	3,924,331	4,274,444	3,175,366
First 11 mos., 1945	5,728,125	4,611,895	25,360,152	351,984	36,052,156	37,143,015	3,387,251
First 11 mos., 1941	23,430,658		32,683,930	1,195,716	57,310,304	54,690,200	4,377,171

an annual consumption of 32,000,000 yards of woven goods and 6,500,000 pounds of knit goods for civilian uses for the same period; and the mechanical rubber goods section estimated the consumption of 66,000,000 pounds of ducks, 45,000,000 yards of sheetings and 38,000,000 yards of operating supplies (wrapper and lining fabrics).

In view of the present-day shortages of textiles, these consumption figures were mentioned, Mr. Lockwood said, because of the belief that the cotton textile industry as a supplier to the rubber manufacturing industry may be injured by too much pessimism as to the future. The cause of the cotton textile industry can be even more damaged if it fails to give full consideration to the problems of research and cooperation, it was added.

"We feel, that with synthetics gaining more and more consumer acceptance each day, it is more and more important that your cotton fabrics be engineered," Mr. Lockwood declared. "In too many cases in the past it has been necessary for our industry to accept so-called standard constructions. If, through cooperative research, these fabrics had been engineered, they would have served the ultimate consumer better, and often more economically."

In conclusion, the speaker urged the cotton textile industry to oppose strongly misguided and uneconomic efforts to foster price stability regardless of consequences to its effect on competitive markets and suggested that the fields of glamorized competitive fibers and luxury-item business might be less profitable in the long run than the field of suppliers to the rubber and other staple industries.

In talking before the Leather & Shoe Finders Association, Mr. Lockwood described the production during 1944 of 77,000,000 pairs of soles and 104,000,000 pairs of heels for the Armed Forces and 279,000,000 pairs of heels and 107,000,000 pairs of soles for civilian needs as a war record the sole and heel industry was proud of.

The sole and heel industry is not just content to produce something to sell, but it will see that it sells the best, it was said. The technical committee of the industry is now working in conjunction with the Office of Rubber Reserve to produce special polymers of synthetic rubber particularly suitable for the manufacture of soles and heels. It was indicated that for black items very little, if any, improvement in quality would result from the replacement of part of the synthetic by natural rubber, but as to tan and other colored items, natural rubber will be added, if available, when the scientists and technicians of the industry feel the quality of the final product will be thereby improved.

In its regular monthly report on the output of pneumatic casings, the RMA reported that passenger-car tire production rose 1.55% in November. Production of truck and bus tires was off 7.74% from the preceding month, and the output of passenger, truck, and bus tubes declined 0.69%. The detailed report, as given above, proves, however, the Association said, that several months of increasing production will be required to fill civilian distribution pipelines which have been almost exhausted in the four war years and to establish adequate working inventories if passenger-car tires are to be brought into anywhere near normal supply in 1946.

Reports on Far Eastern Rubber

With regard to the statement made last month that the 8,000-ton cargo of rubber which arrived in New York on the *Canton Victory* during the Christmas holidays having cost $6,000,000, or about 37¢ a pound, the RFC denied that any payment had been made and said that until the negotiations now being conducted with the countries that produce natural rubber were concluded, no payment could be made since no price was available. Late in January negotiations were apparently still in progress since no price had been announced. Some of the points at issue in the price talks are believed to center around the fact that the British are said to be basing their comparatively high price demands on the "buying price" they are supposed to be offering native growers and other producers of 17½¢ a pound. With processing and shipping costs added, the British selling price would be about double what the United States wants to pay.

According to a report attributed to Charles Stevenson, formerly office manager of the Goodyear Tire & Rubber Co.'s Java plant, and recently returned to Akron after three years in a Japanese prison camp, the lack of stabilized currency in the Dutch East Indies prevents rubber trade in that area. The Japanese "guilder" is the currency mainly used in Java, Mr. Stevenson said, but "until the political situation is improved, its circulation will be retarded." He also expressed the opinion that the majority of Indonesians "don't give a hang who runs the country" and "all they want is to make a living."

According to an AP report from Saigon, Indo-China, on December 30, lack of labor and lighterage is delaying shipment of 115,000 tons of rubber to the United States, but the first cargo from that country left on the Isthmian ship *Red Rover* with 8,000 tons late in December. The Liberty ship *Mary A. Livermore*, the second United States-bound cargo ship, was being loaded with another 8,000 tons of rubber as the year 1946 began. Monthly shipments of 16,000 tons of rubber to the United States are scheduled.

A few days later, on January 4, another AP report stated that 20,000 tons of rubber in a government warehouse near Saigon was aflame and that rubber estates and villages in an area 60 miles north of Saigon were being destroyed by the Annamese.

Some interesting information on the Japanese rubber industry appeared in the *New York Journal of Commerce* on January 7. The information was taken from a report by scientific and economic advisers of the American occupying forces and was made to Ambassador Edwin W. Pauley, chief of the United States Reparations Commission. The machinery in Japan's eight synthetic rubber plants lies idle owing to the shortage of raw materials and fuel and prohibitive production costs, it was said. Japanese figures for synthetic rubber production, devoted mostly to making self-sealing

fuel tanks, indicated an annual capacity for the eight plants of 750 tons. Actually, 1944 production was only 220 metric tons, and the total output for the 1941-45 period was 365 metric tons, the report said. These figures were not considered accurate by the American observers. Mitsubishi Chemical Industries, reporting on two of the eight plants, listed one as using the alcohol process and another as using the monovinyl-acetylene process.

There are 341 rubber products factories in Japan with an aggregate consumptive capacity for crude rubber of 32,066 tons. Of these, 35 are tire factories with an annual crude rubber consumption capacity of 8,929 metric tons, the report to the Reparations Mission said.

The Management-Labor Situation

In spite of the increasing number of disagreements between management and labor in the steel, electrical, meat packing, and other industries and the development of what amounted to a national strike crisis during January, industrial relations in the rubber industry, in general, appeared more satisfactory than they have been for some months. Admittedly, strikes in the basic industries will affect relations in the rubber industry directly or indirectly within a very short time; in fact it was reported toward the end of January that a survey of executives of the major tire producing firms in Akron resulted in the prediction that tire manufacture would be suspended within a few weeks for lack of steel wire used in tire beads.

Umpire Reinstated at Goodyear—Akron

Negotiations on controversial issues between Goodyear Tire & Rubber Co. management and the local and international URWA officers at Akron, O., finally produced a reversal of the former stand of the local union on the eight-hour day issue and an agreement for the return of William E. Simkin to the post of impartial umpire for settling labor disputes between management and the local union at the Goodyear plant at Akron. Mr. Simkin resigned as umpire during December when the local union failed to follow his decision that the majority of the Goodyear workers at Akron should return to eight-hour shifts until the manpower was available to permit resuming the peacetime six-hour shift.

In return the Goodyear company restored the check-off of union dues at the Akron plants and also agreed to bargain collectively with the URWA on a corporation-wide basis. Details of the bargaining agreement were not completely settled, but it was understood that the Goodyear company had agreed to the inclusion of all its American plants except the Kelly-Springfield plant at Cumberland, Md. The plant-wide bargaining, at least in its initial stages, will be confined to the current URWA seven-point wage-hour program.

Mr. Simkin will receive a retainer of $4,000 a year to handle 50 cases, and when the number of cases he is required to decide pass that number, he will be reimbursed on a sliding scale, it was reported. The cost of the umpire is to be shared equally by the company and the union.

The Akron local URWA at the Goodyear Akron plant voted on January 10, 4,330 to 376, in favor of strike action on wage issues. This was not considered to indicate any immediate strike action, and the agreement for corporation-wide bargaining was expected to delay any strike for a considerable period.

Other Industrial Relations News

The local URWA union at the Akron plant of the Firestone Tire & Rubber Co. voted on January 20, 5,935 to 565 in favor of strike action, and the local URWA union at the Memphis, Tenn., Firestone plant on January 9, also voted 2,792 to 113 along the same lines. Union officials stated that these actions would not mean any immediate work stoppage, but would strengthen the union's hand in collective bargaining with the company. Firestone at Akron on January 9 informed the local union that it was not prepared to make any wage increase offers until the national pattern has been set. The company was reported to have said that there was no point to holding further meetings with the union on the subject at present, but pointed out that further meetings will be scheduled as soon as a national pattern is established.

Seiberling Rubber Co. early in January made an offer to its local URWA union at Barberton, O., of a 12¢-an-hour increase, a 7¢-an-hour adjustment for engineering and maintenance workers, double time for Sundays and holidays, and an increase of 3¢-an-hour in the night shift bonus. The local union accepted this offer since the contract included a clause permitting the union to reopen wage negotiations in the event higher wage rates were established in the industry.

The NLRB on January 11 ordered an election by secret ballot within 30 days among the supervisory workers of The B. F. Goodrich Co. at Akron to determine whether they want to be represented by the Foreman's Association of America. This action is one of several, all identical, which have been made in the last few weeks, following the decision of the NLRB in the precedent-setting Packard Motor Car Co. case, that supervisory workers were "employes" rather than "employers," at Packard. Goodrich has held the opposite viewpoint and has indicated that it will seek legal recourse.

OPA Changes

Additional orders, as follows, have been appended to RMPR 528—Tires and Tubes, Recapping and Repairing, and Certain Repair Materials—establishing retail ceilings for the new products indicated: No. 78, industrial solids, industrial pressed-on solids, and industrial retreads constructed of neoprene by United States Rubber Co., New York, N. Y.; No. 79, 7.50-15, 10-ply Universal truck tire, B. F. Goodrich Co., Akron, O.; No. 80, two traction logger and one solid industrial tire, Firestone Tire & Rubber Co., Akron; No. 81, 5.50-15 and 6.00-15 Firestone passenger-car tires; No. 82, six sizes of Goodrich Seal-O-Matic passenger-car inner tubes; No. 83, self-sealing, bullet-proof 6.00-20 natural rubber tube, Star Rubber Co.; No. 84, four sizes of Gillette logger tires, U. S. Rubber; No. 85, 7.50-20, 12-ply All-state logging tire, Sears, Roebuck & Co., Chicago, Ill.; No. 86, one wheelbarrow, one garden tractor, and two pneumatic industrial tires, Frank G. Schenuit Rubber Co., Baltimore, Md.

Amendment 9, MPR 143—Wholesale Prices for New Rubber Tires and Tubes—adds to its price schedules four- and six-ply 5.50-15 and 6.00-15 sizes of tires. Also added to Section 3 (a) is the sentence: "Sales by persons owned or controlled by a brand owner or brand owners shall be deemed sales by the brand owner within the meaning of this section."

The following orders were revoked January 1: Rev. R0 1C—Tire Rationing Regulations for the Virgin Islands; R0 1D—Tires, Tubes, Recapping, and Camelback in Canal Zone; Rev. R0 1E—Tires, Territory of Hawaii; R0 1F—Tire Rationing Regulations for Alaska.

Amendment 1 to Order 13 under 3 (e), GMPR, provides that the provisions of this order shall not be used to establish maximum prices on or after January 5 for footwear with non-marking synthetic rubber soles. Order 102 under 3 (e) applies to all sales of Rentaflote rubber inflatable air floats made by Hodgman Rubber Co., Framingham, Mass.

The following orders have been issued on RMPR 165, SSR 47, relative to retail shoe repair services involving Neolite full- or half-soles manufactured by Goodyear Tire & Rubber Co. or Panolene full- or half-soles made by Panther-Panco Rubber Co.: Amendment 5; Region VIII Orders G-2, G-3, G-4, G-5, G-6, G-7; Region V, Order G-2, Amendment 1.

Two additional amendments were added to MPR 580 last month: Amendment 3 to Order 58, which sets maximum prices on York, Wrap-Around, and Shortee styles of costs made by Rainwear, Inc., and Amendment 3, Order 208, establishing ceilings for five ladies' raincoats and one men's, made by Climatic Rainwater Co., Inc.

Orders 159, 160, and 161, MPR 478, authorize maximum prices for neoprene coated and cotton flocked fabrics made by Hood Rubber Co., Watertown, Mass.

Order 4730, MPR 188, Ace Rubber Products, Inc., was revoked January 18. Order 4827 approves ceilings for Buna S kneeling pads made by Hedlund-Noltimier Co., Chicago, Ill.

MPR 519—Thermosetting Plastic Laminates—was suspended January 11 and its products made subject to MPR 406—Synthetic Resins and Plastic Materials and Substitute Rubber—thus raising ceilings about 10%.

Amendment 3, RMPR 561—Gum Naval Stores—establishes for the first time ceilings on gum turpentine.

Amendment 7, SO 129—Exemption and Suspension from Price Control of

Machines, Parts, Industrial Materials and Services—includes among the items affected: advertising streamers made from coated fabrics; bust forms and fillers (other than surgical bust forms and fillers); the service of repairing airplane tires with types of repairs designed for airplane use; plastic pipe and tubing for plumbing manufactured from copolymer vinyl and vinylidene; pneumatic life rafts.

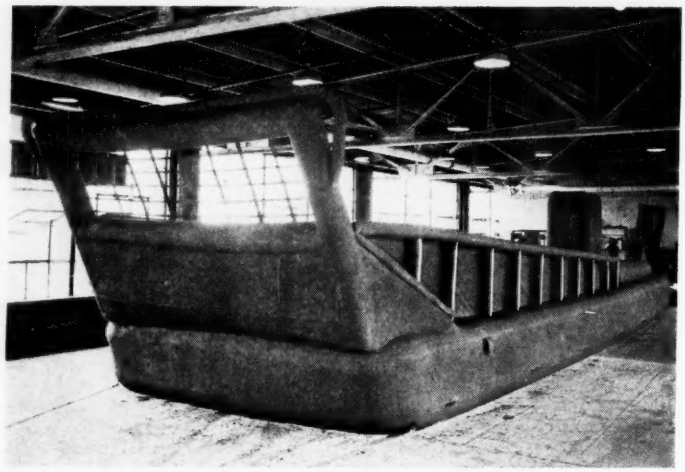
The following orders have been added to MPR 591. Order 213 relates to maximum prices of farm and home freezers made by Manitowoc Ship Building Co. and sold by the Firestone Tire & Rubber Co., Akron, O., and resellers purchasing from Firestone; while Order 222 covers ceilings to Firestone of farm and home freezer units manufactured by Victor Products Corp. The next order authorizes maximum prices on a farm freezer made by Goodyear Aircraft Corp., Akron.

Civilian Production Administration, Washington, D. C., has made two changes in R-1, as Amended November 2, 1945. Amendment 1, effective January 1, prohibits manufacturers of new motor vehicles, including automobiles, trucks, trailers, and tractors, from securing tires and inner tubes as spares. Amendment 2 to Appendix II, as Amended November 15, 1945, issued January 2, permits manufacture of synthetic pneumatic tires or tire casings without the "red dot" identification mark. Such tires, however, will continue to bear on both sides of the tire a permanent brand indicating the synthetic construction. This brand must be at least ⅝-inch high unless this size is found to be unreasonably large. The brand for tire casings made of synthetic rubber will continue to be the letter "S," together with the number identifying the synthetic construction.

Suspension Order S-915 has been issued by CPA against The Norwalk Tire & Rubber Co. for exceeding quotas of rubber and lead in the manufacture of replacement batteries.

W. James Sears, director of the CPA Rubber Division on January 19 announced that Earl W. Glen, of Goodyear Tire & Rubber Co., had been appointed assistant director in charge of technical operations of that division. Mr. Glen succeeds George L. Allison, who will return to The B. F. Goodrich Co., Akron. The appointment of Mr. Glen, on leave from his company, is in line with the rubber manufacturing industry's policy of lending top technical men to assist the CPA, Mr. Sears said. Mr. Glen has worked on development and design of rubber products for Goodyear for 16 years and more recently was ordnance consultant on rubber in the European theater of war and spent eight months investigating the German rubber industry and aiding in the rehabilitation of rubber manufacturing plants in France and Belgium.

Thomas E. Parks, Jr., of Dallas, Tex., has been appointed chief of the appeals section of the Rubber Division, and Gerald E. Perry, of Maplewood, N. J., formerly chief of the appeals section, will assist in the work of technical operations.



Replica of LCM Built by Goodyear

Rubber Devices Fool Enemy

The lifting of a long military censorship has revealed a giant deception practiced on the Germans before D-Day. PT boats complete with armament, and landing craft and barges carrying tanks, artillery and other combat equipment, appeared and disappeared overnight and in great numbers along the English Channel coast in the days preceding June 6, 1944, much to the confusion of German observers and the High Command. This huge ruse was made possible by the production of painted pneumatic balloon-fabric models, in full scale, of the craft and equipment required for this decoy operation. Folded compactly when deflated, and readily transportable, the close resemblance of the models to actual equipment, when inflated, made them utterly deceiving to German reconnaissance pilots. Manufacturers of these models included The Goodyear Tire & Rubber Co., Akron, the United States Rubber Co., New York, and The Firestone Tire & Rubber Co. at its Akron and Memphis, Tenn., plants.

GE Deveopments

(Continued from page 679)

makes non-supported (without fabric) films of plastic as thin as 0.002-inch. The electric control provides a constant-speed regulating system, preset speed, and current-limit control for regenerative breaking under emergency conditions. A laminated plastic combining the mechanical properties of a fabric base with the arc resistance of inorganic refractories was designed for use as arc barriers where severe arcing conditions must be withstood, as in switchgear. Another laminate with glass-fabric base, incorporating a Permafil solventless-varnish resin, was designed for applications where dimensional stability and superior machinability are required, as in coil forms for precision resistors. For radar and other high-frequency devices, a thermosetting material was developed which only softens to a rubbery gel at high temperatures and which will not flow. No decomposition is noticeable at 392° F., and upon cooling it hardens again without losing its shape. Permafil solventless-varnish, although available in relatively small quantities, was given extended applications during the year for impregnating, laminating, and casting, and as a base for protective coating and compound binders. The uncured material is an easily poured liquid which cures to a hard, dense solid upon heating. The curing is accomplished with practically no volatile loss, particularly important in filling and impregnating applications.

New York Group Chairman

George J. Wyrough, assistant vice president and factory manager of The Whitehead Bros. Rubber Co., Trenton 4, N. J., has been elected chairman of the New York Rubber Group for 1946.

Mr. Wyrough, born in Altoona, Pa., January 6, 1900, received his B.S. in industrial chemistry from Pennsylvania State College in 1920. He began his successful career in the rubber industry in 1920 with the Murray Rubber Co., where he remained until 1928 when he joined the Republic Rubber Co. Then in 1937 he became a staff member of the Thermoid Co. and later that year became associated with The Whitehead Bros. Rubber Co. His entire time has been devoted to mechanical rubber goods.

A member of Phi Lambda Upsilon, Sigma Tau, American Chemical Society, and American Society for Testing Materials, he also is on the mechanical goods technical committee of The Rubber Manufacturers Association, Inc., and the technical advisory committee of the National Synthetic Rubber Corp.

Mr. Wyrough, who is married and has three children, Mary, Jean, and George, resides at 102 School Lane, Trenton, N. J.

"Current Export Bulletin No. 306," issued January 7 by the United States Department of Commerce, covers the export program for cotton piece goods and cotton fabricated products for the first quarter of 1945, including osnaburgs, sheetings, drills, surgical and bandage cloth.

EASTERN and SOUTHERN



Armand

J. E. Hart



M. E. Davis

Taylor Instrument Cos., Rochester, N. Y., last month announced the following changes in the personnel of its sales organization. J. E. Hart, formerly of the Taylor organization at Rochester and for the past two years Deputy Chief of the WPB Industrial Instrument Branch, has returned to Taylor. His new assignment is manager of the Boston sales office from which point the New England territory is covered. R. E. Flikkema, for 20 years manager of the Pittsburgh office, was transferred to Tulsa to take charge of that branch. With him is A. R. Wagner, who joined Taylor last spring and who has had considerable experience in the oil industry throughout the Southwest. F. C. Fuzzard, who worked with Mr. Flikkema, several years was made acting manager of the Pittsburgh territory, and A. C. Mahana, of Rochester, is assisting him there. J. A. Grant, who started in the Philadelphia office nearly ten years ago and was later in charge of sales activities centered in Greenville, N. C., has returned to Philadelphia to be part of that sales organization. He spent the last three years with the U. S. Navy with the rank of lieutenant commander.

Lee Rubber & Tire Corp., Conshohocken, Pa., held its annual meeting on January 24 at which President A. A. Garthwaite revealed that installation of new machinery at the plant is increasing capacity to 80% above the prewar figure.

All-Top Rubber Products & Specialty Co., 354 Halsey St., Newark 2, N. J., recently was incorporated in the State of New Jersey for $100,000. Officers are: Wallace J. Crowley, president; O. S. Edmiston, Jr., vice president; and Robert J. Heiney, secretary-treasurer. The firm is setting up its own molds for the manufacture of household specialties, also soliciting industrials. Besides the company has organized a department for custom rubber grinding to specifications.

Opens Trenton Office

C. J. Harwick, president of Standard Chemical Co., Akron, O., has announced the opening of a new branch office in the Broad St. Bank Bldg., Trenton, N. J., with complete warehouse facilities for serving the Middle-Atlantic States. These new offices are under the management of M. E. Davis, formerly with J. M. Huber, Inc., New York, N. Y., as rubber service manager.

After acquiring his science degree at the University of Illinois in 1931, Mr. Davis joined A. O. Smith Corp. as research chemist. Then in 1933 he went to The B. F. Goodrich Co.'s general laboratories in Akron, was later transferred to the raw materials department, and next served as factory compounder in the mechanical goods division. He resigned in 1937 to become compounder for The General Tire & Rubber Co.'s mechanical goods plant in Wabash, Ind. In 1940, however, Mr. Davis joined the Huber technical sales staff.

New Research Positions

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., has announced a new series of research positions in the technical division of the rayon department designed to make a scientific career as attractive as the administrative field in industry. The plan, which departs from industry's general policy of recognizing outstanding scientists by promotion to administrative posts in research, provides for three classifications of "research associates." According to E. B. Benger, manager of the technical division, the plan places greater stress on fundamental work by establishing research positions with salary rates corresponding to those for supervisors, managers, and assistant research directors. The new classifications, which are open to chemists, engineers, and other technically trained employes demonstrating unusual scientific ability, are specified by the titles of "junior research associate," "research associate," and "senior research associate."

Dr. Benger, who announced the plan at a luncheon in the Hotel Du Pont, named three members of his staff to the new classifications. W. E. Roseveare, research supervisor in charge of the basic research group of the viscose rayon research section at the Spruance Plant, Richmond, Va., and E. F. Izard, pioneering research section at the Yerkes Plant, Buffalo, N. Y., were appointed research associates. E. V. Lewis, of the nylon research section, Wilmington, became a junior research associate. Senior research associates will be chosen from men of long service, distinguished scientific attainments, and high creative potential, with capabilities for originating, organizing, and conducting their own research programs. They will have substantial freedom in selection of work and in the selection of assistants. They will be encouraged to attend any scientific meetings in which they are interested, to contact other laboratories and workers, both in and outside the company, and to publish scientific papers. The new classification plan will roughly double the number of promotions toward which scientists in the technical division of the rayon department can aspire. Appointments are to be made gradually and only after men have qualified for an appropriate classification.

Carbon Dispersions, Inc., a recently organized corporation with factory and laboratory at 27 Haynes Ave., Newark 5, N. J., will manufacture all types of carbon black dispersions for the rubber, printing ink, paint, carbon paper, and plastics industries. These dispersions, it is said, will cut manufacturing costs and eliminate the dusty and dirty mixing operations encountered in the ordinary handling of carbon blacks. The company also plans to develop new lines of special products not heretofore offered to industry. Arthur Brauch is vice president and general manager in charge of plant operations and research for the new company.

General Electric Co., Schenectady, N. Y., to obtain more comprehensive industrial application engineering coverage has added three new divisions to its industrial engineering divisions: power electronics, materials handling and testing equipment, and rubber and printing, and has also reorganized its machinery division. The rubber and printing division, under the direction of G. W. Knapp, will handle rubber processing and all branches of the printing industry in addition to encouraging the application of electrical apparatus in the food industries.

McLain Organization, advertising and sales planning concern, 12 S. 12th St., Philadelphia 7, Pa., last month announced the appointment of John O'Hara Harte as director of public relations and plans and also the formation of a public relations department to service its clients as well as additional outside business. Mr. Harte has spent many years in public relations and advertising, most recently with Menasco Mfg. Co., Burbank, Calif.

Westinghouse's 1945 Developments

The research and engineering review of the Westinghouse Electric Corp., Pittsburgh, Pa., deals not only with wartime developments of 1945, but includes developments of previous wartime years hitherto secret. The review takes particular note of conversion of the implements of war or their underlying principles to peacetime uses. Both M. W. Smith, vice president in charge of engineering, and L. W. Chubb, director of the research laboratories, agree that the many developments in 1945 have brought about a virtual revolution in science.

Westinghouse developments for the atomic bomb included the Calutron, an electric atom sorter for separating U-235 atoms from ordinary uranium, a factory for the production of pure uranium, and a diffusion pump for attaining high vacuums. In the field of jet propulsion the company has developed a geared gas turbine that can be used in planes to carry heavier loads for greater distances than possible with either reciprocating or pure jet engines. For radar, Westinghouse developed the TR box, an electronic switch for disconnecting the receiver from the antenna during transmission; the proximity fuse; Stratovision, a method for aerial relaying of television and FM broadcasts; the Resnatron, an electronic radar wave scrambler that can be used as a generator and oscillator in television; an electronic "blow torch," and the Precipitron, an electrostatic air cleaner for home and industrial use. Other developments include electric torpedoes, electric ship control mechanisms, deck-edge elevators for carriers, tracer control ship propeller cutters, the "electrical thinker," the tank stabilizer which can be adapted to railroad car bodies, many airplane safety devices, the Refractaloys—a group of high-temperature alloys—and the silicone resins, liquids, varnishes, and rubbers.

Westinghouse Electric International Co. has formed a new service department to help customers in South America and the Caribbean area with problems of equipment and operation of electrical machinery. The new department, headed by J. F. Mann, former assistant manager of the industrial apparatus department, will supplement present offices in the area and will specialize in providing engineering service counsel and advice on the operation of electrical equipment in power stations, industrial plants and electric railways.

Wilmington Chemical Corp., 10 E. 40th St., New York 16, N. Y., has appointed as Midwest representative Edward E. Zeilstra, formerly chief rubber chemist of John A. Roebling's Sons Co., wire division. Mr. Zeilstra, a native of Grand Rapids, Mich., was graduated from Calvin College, with a B.Ch.E. degree, and joined Ford Motor Co. in 1935, where he became technical supervisor of the inner tube and miscellaneous rubber goods department. In January, 1943, he became chief rubber chemist and rubber development engineer of Roebling's. Mr. Zeilstra will make his headquarters in First Central Tower, Akron, O.

Riverside & Dan River Cotton Mills, Danville, Va., has announced that textile machinery of new design, fabricated specifically for the treatment of textile yarns or rovings made of various natural or synthetic fibers by the company's Fiber-Bonded process, a synthetic resin process, will be manufactured by Walter Kidde & Co., Belleville, N. J. The new machinery consists of a unit for the treatment of the textile yarn or roving with synthetic resins, or such bonding agents as may be desired, and a second unit for the tensioning and curing of the treated yarn or roving. For certain products these two operations may be combined to give one continuous operation. The new machinery is expected to equal or exceed the following performance: provide an average tensile strength increase in rovings, yarns, or cords of from 40 to 60% on any raw material used; give higher production on conventional textile machinery preliminary to bonding; eliminate conventional processes such as spinning, spooling, warping, and twisting; and eliminate foreign matter from cotton roving during the bonding treatment. Products for which the Fiber-Bonded process is especially suited include belt ducking, webbing, hydraulic brake hose and roving, V-belt cord, conveyer belt fabric, and laminated fabrics. Fiber-Bonded fabrics simplify the laminating process and give laminates with higher bonded strength and lower water absorption than those made with conventional fabrics. Simplification in processing and higher strength in products are obtained by use of this method in other applications.

Hamilton Rubber Mfg. Corp., Trenton 3, N. J., is the new name of the Hamilton Rubber Mfg. Co., following a change of ownership, according to Albert M. Kahn, head of the new company, and A. Boyd Cornell, president of Hamilton. This is the second change in ownership of the company in six months. The late Chester A. Bolles was chairman of Hamilton Rubber Mfg. Co. until his plane crashed in the Hudson River in November. Mr. Kahn, who is also president of the Acme Rubber Mfg. Co., Trenton, a major interest in which he and his associates purchased last May, becomes president of the Hamilton corporation; while Mr. Cornell becomes executive vice president. Ervin W. South remains as vice president, but is succeeded as secretary by Charles A. Gale. Also remaining a vice president is L. J. Howell, whose other post, assistant secretary, is now assumed by Mr. South. O. E. Martens is still treasurer. The firm will continue to manufacture mechanical rubber goods at its present plant, and no other changes in management or business are contemplated.

New York Rubber Corp., Empire State Bldg., New York, N. Y., has announced that its Middletown plant, which was exclusively engaged in the production of pneumatic lifesaving equipment during the war, has there resumed, after a temporary cessation of operations, manufacture of its regular "Airubber" line of pneumatic products and has added a new item, the Stow-Away Bed.

Sun Oil Appointments

Sun Oil Co., Philadelphia, Pa., has appointed Frank R. Markley general sales manager. Mr. Markley, formerly manager of the company's industrial products department, will serve as assistant to Samuel B. Eckert, vice president in charge of marketing.

Mr. Barkley received his degree in electrical engineering at the Pratt Institute of Technology and joined Sun Oil in 1920 as a lubrication engineer and then became New York manager of industrial oil sales and later special representative in the general sales department in Philadelphia. In 1933 he was appointed general manager of the export department, directing the company's marketing activities throughout the world. In 1937 he was recalled to the United States to organize the industrial products department.

Ray H. Anders succeeds Mr. Markley as manager of the industrial products department. Assistant manager of the department since September 15, 1944, Mr. Anders came to the company in 1929 as an industrial products salesman and became manager of industrial products sales in the Philadelphia division in 1937. Prior to joining Sun, Mr. Anders was employed by the George W. Blabon Corp., and later served as manager of the Allentown, Pa., office of The B. F. Goodrich Co.

At the same time Mr. Eckert also announced the appointment of Maximilian H. Leister as general manager of Sun's motor products department. He will devote his full time to supervising the sale of all motor products, the operation of service stations, and all advertising. Mr. Leister, acting general sales manager since April 1, 1942, joined the company as assistant advertising manager in 1921, became manager of motor products sales in the Philadelphia district on April 1, 1924, and in December of the same year was appointed general manager of the motor oil division and director of advertising.

J. O. Ross Engineering Corp., New York, N. Y., last month celebrated its twenty-fifth anniversary. Festivities included a dinner party at the Hotel Roosevelt on January 17, attended by about 200 guests including employes from all the company's offices in New York, New Brunswick, Boston, Chicago, Detroit, Los Angeles, and Canada; and a theater party the evening of January 18. Gifts from the employes were presented to J. O. Ross, founder of the business and now chairman of the board, and to Vice President F. W. Partsch and Richard Schultz, both of whom were members of the original organization when the business started in 1921. S. W. Fletcher, president of the company, presented the gifts on behalf of the employes.

Calco Chemical division, American Cyanamid Co., Bound Brook, N. J., has added F. B. Havens to the technical service staff of the pigment department. Mr. Havens, formerly vice president and chief chemist of the Prince Mfg. Co., Bowmanstown, Pa., will devote his time to problems involved in the application of pigments to protective and decorative coatings.

Chemical Industries Show

Occupying four floors of Grand Central Palace, New York, N. Y., approximately 375 exhibitors will display a wide variety of materials and appliances at the Twentieth Exposition of Chemical Industries to be held February 25 to March 2. Especially timely in view of reconversion, the exposition will reveal many products and processes that were restricted to government uses during the war and are now available to free enterprise.

Exhibits will cover all fields of chemicals and chemical equipment, including the most accurate instruments for measuring and regulating plant and laboratory processes. They include also special materials of many kinds developed to meet the exacting requirements of chemical processing: namely, greater resistance to high temperature and pressure, resistance to corrosive materials, reduction to finer particle sizes, more effective and leakproof means of mixing, treating, separating, handling, and storing costly and dangerous materials; even means for changing over from batch operations to continuous processes.

Of interest in the field of plastics and elastomers will be an apparatus for demonstrating the low temperature flexibility effects of various plasticizers. For separation processes, samples of 400-mesh Monel wire cloth will be shown and testing sieves having up to 160,000 holes to the square inch. In the field of infusions will be displayed a new electronic automatic flow controller for very minute flows claimed to be capable of measuring flow rates down to 100 cc. per minute. There will also be an automatic ratio controller designed to proportion two or more fluids so that the various streams remain in constant proportion regardless of variations in total flow. In addition to several exhibits featuring laboratory glassware and other more or less conventional specialties, there will be featured dispersion mixing techniques, vacuum mixers, a continuous centrifugation apparatus, and a still designed to meet chemical and pharmaceutical requirements for hydrogen-free water.

The exposition is under the management of the International Exposition Co., with Charles F. Roth, manager, and E. K. Stevens, associate manager. It will be opened to visitors at 2:00 p.m. Monday, February 25, opening daily thereafter from 11:00 a. m. to 10:00 p. m. until Saturday, March 2, when the exposition closes at 6:00 p. m. All visitors are required to register at the door, presenting cards of invitation or other credentials indicating a professional or business interest in the exhibits. The general public will not be admitted.

Alice J. Gitter, first woman to have been graduated in ceramic engineering in the United States, has joined Whittaker, Clark & Daniels, Inc., New York, N. Y., where she will do market development work and serve as technical consultant to the company's customers on non-metallic minerals. Miss Gitter was previously chief of the Clay-Talc Unit, WPB. She is also a member of the American Ceramic Society and the Engineers' Institute.

Personnel Advanced

United States Rubber Co., 1230 Sixth Ave., New York, N. Y., last month announced several changes in its organization.

C. L. Wanamaker, former general manager of the munitions department, has been made production manager of the tire division, with headquarters in Detroit. At the same time Curtis L. Moody and J. A. Daly were named assistant production managers for the tire division, and Frank L. Swanson was appointed factory manager of the Detroit tire plant. All are veteran U. S. Rubber employes.

Robert R. Walker, formerly a lieutenant colonel in the AAF, has returned to the rubber company and been made Pittsburgh fleet sales representative in charge of commercial merchandising activities for U. S. tires in the Pittsburgh district.

Leon I. Friedlander has been appointed southeastern district representative of the shoe products department of U. S. Rubber with headquarters in Atlanta, Ga., which district includes North and South Carolina, Georgia, Florida, Mississippi, Alabama, Louisiana, and eastern Tennessee. Mr. Friedlander was recently released from the Army after serving in the Egyptian-Libyan theater and the Middle East, where his responsibilities included the handling of shoe repairs for the Army. He entered the service as a private and rose through the ranks to the grade of first lieutenant.

C. L. Foutz, formerly factory manager for U. S. Rubber at the Charlotte ordnance plant and subsequently acting general manager of the company's munitions division, has been appointed director of manufacturing for United States Rubber Export Co., Ltd., with headquarters in N. Y. He will be in charge of production at company owned and affiliated plants in Cuba, Colombia, England, Mexico, Sweden, Uruguay, and Venezuela. These plants are engaged in making tires and rubber footwear. A native of Greenville, O., and a graduate of the Naval Academy at Annapolis, Mr. Foutz came with U. S. Rubber in 1919, starting as a tire builder in the Detroit plant. He later became chief inspector, in 1922 was sent to Indianapolis as assistant factory manager, and subsequently was transferred to the Naugatuck chemical plant. In 1932 he went to Passaic as factory manager, where he remained until the outbreak of the war, when he was made service manager of the newly created munitions division. Two years later, he was placed in charge of the Des Moines ordnance plant, but transferred to the Charlotte plant, January 1, 1944, which he operated as factory manager until the end of the war.

Wallace E. Cake, director of the plantation research department, has been appointed assistant managing director of the plantation division of U. S. Rubber, with headquarters at the main offices of the company. A native of Ann Arbor, Mich., Mr. Cake joined U. S. Rubber in 1922 when he started as a chemist after receiving his degrees from the University of Michigan. He went immediately to the company's plantations in Malaya and Sumatra with his headquarters at Boenoet, Sumatra. Except for periodic leaves of absence, Mr. Cake spent his entire time in the Far East. He pioneered in chemical research there, becoming director of the company's plantation research department in 1930. He was taken prisoner by the Japanese in March, 1942, and spent three years interned on Sumatra. He was released in October, 1945. Before returning to this country in November, Mr. Cake was able to observe at first hand the effects of Japanese occupation upon the plantations.

Several changes have also been made in the Gillette tire division. J. J. Stephens has been appointed merchandise manager for the division, with his headquarters at the company's executive offices in New York. Succeeding Mr. Stephens as merchandise manager in charge of battery, accessory, and repair material sales for Gillette, is F. A. Foster, a sales representative for the Memphis district.

C. E. Gotshall has been assigned to the Chicago district managership for Gillette. He was transferred from New York where he had served as merchandise manager in charge of batteries, accessories, repair materials, tires, and tubes.

The Gillette tire division has opened a district office at 5850 Cass Ave., Detroit 2, Mich., in charge of R. B. Frye, district manager for Gillette.

Owing to a sudden illness, George R. Vila was obliged to cancel his appearance at the January 11 meeting of the Southern California Section of the American Chemical Society. Mr. Vila, assistant development manager of Naugatuck Chemical division, had planned to speak on "Polymerization: A New Tool for the Rubber Technologist."

Other Developments

The Army's 53-million-dollar ordnance plant in Des Moines, Iowa, which poured out nearly four billion rounds of ammunition during the war, has been turned over officially to the RFC as surplus property. The largest War Department plant so far taken over by the RFC, it was transferred under a new procedure developed by Army Ordnance officers in cooperation with the RFC and U. S. Rubber, operator of the plant. The plant is being offered for sale, but there have been no bidders so far. Included in the sales offer are 285 buildings, complete with machinery, raw materials and supplies, and 4,400 acres of land. The Weitz Co., Des Moines, contractor who directed construction of the plant, has been made custodian of the property for the RFC. Brig. Gen. James Kirk of Washington, Chief of the Small Arms Division of the Ordnance Department, praised the plant's record as one of the country's most outstanding from the standpoint of efficiency, economy, and safety. He stated that the Ordnance Department was deeply grateful to the people who worked there during the war and to U. S. Rubber, the operator. During the 42 months it was in operation, the plant turned out 1,710,000,000 rounds of .30 caliber ammunition, and 2,025,000,000 rounds of .50 caliber cartridges. The total operating cost was 379 million dollars, and the construction cost 53 millions. New processes and improved methods, developed by engineers of U. S. Rubber in collaboration with the Ordnance Depart-

ment, resulted in a steady increase in output and saving to the government. The plant was also noted for its outstanding safety records, with a frequency rate of approximately one lost-time accident per million man-hours worked, one of the lowest rates in the country.

U. S. Rubber has reported that it will require 20% more textiles in 1946 than in the average prewar year in order to carry out a greatly expanded production program in tires and other rubber products. The major portion of the textiles will go into tire cord. More rayon will be used than in prewar years, but also required will be increased quantities of high-quality cotton for tire cord, "Lastex" yarn, footwear, rainwear, belting, hose, wire insulation, and many other products.

Dealers were advised by W. D. Baldwin, tires sales manager, that tires would continue to be short for the first half of 1946. Paralleling a similar statement by J. J. Newman, of The B. F. Goodrich Co., Mr. Baldwin said that dealer stocks throughout the country were at a low ebb, and estimated that some eight million tires would be needed for adequate restocking purposes. He stated that U. S. Rubber would continue to pursue its policy of allocating tires to its dealers on the same equitable basis of distribution that it followed during the war. Recapping would be a highly important phase of the business during the next year, he said, and urged dealers to encourage this activity. Relief in the current tire shortage will not be noticeably perceptible until the latter half of 1946, and tire conservation is of utmost importance. He also reported that the company would be in mass production of Butyl inner tubes early in 1946.

An additional line of Keds with Shock-Proof arch cushion was shown to dealers beginning the second week in January. Orders are being accepted for early delivery on the eleven shoes in four distinctive styles, including basketball shoes, utility shoes, and two types of sports oxfords. In addition a loose-lined, molded sole basketball shoe with Shock-Proof arch cushion was shown for fall and winter delivery. All styles carry the Keds label, are 100% washable, have non-marking soles, breathable uppers, and other prewar Keds features. The five styles of Arch Cushion Keds are in addition to 19 shoes in five styles that were announced by U. S. Rubber in November, 1945, as the first Keds available since the Spring of 1942.

The company's Multi-Flex, a flexible, corrugated duct made of glass and asbestos fabrics impregnated with synthetic rubber and plastics, first developed for wartime use, is now finding peacetime applications for conveying air, dust, fumes, and abrasive substances on mechanical equipment and in industrial plants. As previously mentioned, the ducts are light, durable, easy to install, and withstand temperatures up to 350 and down to -70° F. Heating and ventilating ducts have been designed for automobiles, airplanes, railroad cars, and other vehicles. Other applications include carrying many substances in manufacturing plants, bellows for resuscitators and cameras, and dust excluder boots for protecting machine parts against abrasives.

Natural Rubber Price 20¼¢ F.O.B. Far Eastern Ports

The State Department announced on January 28 completion of price negotiations for purchase of natural rubber from British, Dutch, and French areas in the Far East. The price was fixed at 20¼¢ a pound for standard top grades, delivered free on board ocean-going steamers at Far Eastern ports. Under terms of the agreement the RFC subsidiary, Rubber Development Corp., will buy all rubber in those areas allocated to the United States by the Combined Rubber Committee. The agreement will cover the period September 2, 1945, through June 30, 1946, in the case of the Dutch and the French, and the period September 2, 1945, through March 31, 1946, in the case of the United Kingdom, from whose areas substantial quantities of rubber already have been shipped, the announcement said.

R. T. Vanderbilt Co., Inc., 230 Park Ave., New York 17, N. Y., has announced that Roy L. Stoughton has been put in charge of its newly equipped proofing laboratory in East Norwalk, Conn., where he will devote his time to development work for the proofing industry. Mr. Stoughton obtained his B.S. in chemical engineering at the University of New Hampshire. He then spent six years on development work on rubber products for United States Rubber Co., followed by one year with E. I. du Pont de Nemours & Co., Inc., on proofings, and then two years with Middletown Rubber Co., also on proofings. His last five years were spent with the United Aircraft Corp.

U. S. Rubber Reclaiming Co., Inc., 724 Babcock St., Buffalo 5, N. Y., has announced that John G. Augenstein has been added to the laboratory staff as chief chemist. He formerly held the same position with the Pequanoc Rubber Co., Butler, N. J.

Bakelite Corp., a unit of Union Carbide & Carbon Corp., 122 E. 42nd St., New York, N. Y., last month elected Allan Brown vice president in charge of advertising and public relations and George C. Miller vice president and general sales manager, thermoplastic department.

The Rubber Reclaimers Association, Inc., 10 E. 40th St., New York, N. Y., at its annual meeting January 8 at the Hotel Biltmore, New York, held the election of officers for 1946. William Welch, president of Midwest Rubber Reclaiming Co., was elected president; Fred Traflet, vice president of Pequanoc Rubber Co., became vice president; and Charles T. Jansen, Wilmington Chemical Corp., was made secretary-treasurer. The members of the executive committee elected were Jean H. Nesbit (chairman), president, U. S. Rubber Reclaiming Co.; R. E. Casey, Naugatuck Chemical Division, United States Rubber Co.; and Allyn I. Brandt, B. F. Goodrich Chemical Co.

Pittsburgh Plate Glass Co., Pittsburgh, Pa., has named Joseph A. Neubauer technical adviser to its Columbia Chemical division. Mr. Neubauer recently returned from a three-month mission to Germany where he represented the government's Technical and Industrial Intelligence Committee. Prior to his trip abroad, he was superintendent of the chlorine producing works at Natrium, W. Va., operated by the Columbia Chemical division.

Earl Wolf, who has been made superintendent of the Natrium plant, has been associated with the company since 1934 successively holding the positions of junior engineer in the power department, assistant to the plant engineer, and maintenance engineer.

Pittsburgh Plate last month reported a broadening of its retirement program for salaried employes whereby more than 3,200 salaried employes 30 years of age or over who have completed at least three years with the company, but who have not yet reached the retirement age of 65 will be eligible for the retirement program.

American Viscose Corp., 350 Fifth Ave., New York 1, N. Y., through President William C. Appleton, reported that the total United States rayon production in 1945 of nearly 800,000,000 pounds was more than double the prewar output of 380,000,000 pounds in 1939. This expansion has been paralleled by a steady improvement in quality and lowering in price. The significance of the wartime expansion in rayon was that it occurred chiefly in new and improved, stronger and finer types of rayon, including the high-strength rayon yarns designed for use in tire cords and fabrics. Despite the wartime increase in output, the demand for rayon is still considerably greater than the supply. From present indication, said Mr. Appleton, it seems probable that production could again double during the next ten years and reach an annual output of about 1,500,000,000 pounds by 1955, provided present high construction and manufacturing costs can be brought into line.

American Viscose is modernizing its rayon producing plant at Marcus Hook, Pa., by installing a number of new spinning machines and refitting existing equipment, under a program that will be carried out as rapidly as possible. The plant, which produces viscose rayon yarn, was the first rayon plant to be built in the United States, having started operations in 1911. At present it produces high-strength rayon yarn of the type used in tire cords and also standard-strength rayon yarns for clothing and home furnishing materials.

Reconstruction Finance Corp., Washington, D. C., among the items declared surplus by the Army last month and offered to the civilian market included nearly 800,000 pairs of heavy rubber gloves, more than 130,000 rubber aprons, approximately 8,000,000 rolls of friction tape, 2,000,000 rolls of rubber splicing tape.

Bishop Gutta-Percha Co., 420-30 E. 25th St., New York 10, N. Y., has announced that Pendennis W. Reed has succeeded the late James M. Conway as president of the company.

OHIO

Thomas Succeeds Vaughan

Seiberling Rubber Co., Akron, has announced the retirement, due to ill health, of W. A. M. Vaughan, as vice president and treasurer and the election of R. J. Thomas as his successor. Mr. Vaughan joined Seiberling as treasurer upon its founding in December, 1921, and continued in that capacity until 1925, when he left the Company to become executive vice president of the First-Second National Bank. In 1932, Mr. Vaughan rejoined Seiberling as executive vice president and served as such until 1938 when he was elected vice president and treasurer. Prior to joining the Seiberling company, Mr. Vaughan had been treasurer of The Goodyear Tire & Rubber Co. of California and prior thereto had been for many years cashier of the Banco Nacional de Cuba, Havana, Cuba.

Mr. Thomas comes to the Akron organization from Seiberling Rubber Co. of Canada, Ltd., Toronto, Ont., of which company he has been an officer for 19 years, serving first as secretary-treasurer and since 1933 as president and treasurer. He will continue to serve also as treasurer of the Canadian company. Mr. Thomas joined the Seiberling organization in the United States in 1922 and before becoming an officer of the Canadian company served as assistant secretary of the Ohio concern.

Mr. Thomas is succeeded as president of the Canadian Seiberling company by M. L. Brown, former vice president in charge of production of the Canadian company.

Mrs. Gertrude Penfield Seiberling, wife of Frank A. Seiberling, chairman of the board, died January 8. She was 80 years old.

B. F. Goodrich Chemical Co., Rose Bldg., Cleveland, has opened two new offices. The one in New York, N. Y., in the French Bldg., 45th St. and Fifth Ave., will enable the company to serve its customers more efficiently in the eastern territory. Personnel of these offices are: O. E. Isenburg and R. F. Dettelbach, sales representatives for Geon polyvinyl materials; Jack H. Rines, Philadelphia reclaimed rubber sales; Roger Bascom, Hycar synthetic rubber sales; Miss Ruth Depner, chief clerk; and Miss L. M. Tocaben, service clerk.

The other new office is in Room 1119, Field Bldg., Chicago, Ill., where Clyde Segner, handling Geon sales in that area, is in charge.

Goodrich Chemical has taken over from The Philadelphia Rubber Works Co., the sale of Philadelphia reclaimed rubber. Personnel of Philadelphia Rubber Works will, under the new arrangement, continue in the same capacities in which each served in the former company. Sales of Philadelphia reclaimed rubber will be combined with those of the other products of Goodrich Chemical. These now include Geon polyvinyl resins and plastics, Kriston thermosetting plastics, Hycar synthetic rubber, rubber chemicals, and organic chemicals.



Ernest J. Gottfried

Fawick Airflex Co., Inc., Cleveland, has appointed Ernest J. Gottfried service manager. Mr. Gottfried, former test engineer with General Motors diesel engine division, recently returned from Russia where he spent 18 months with the Russian Navy, installing Fawick clutch equipped G.M. diesels in naval craft.

C. B. Hunt & Son, Inc., valve manufacturer, Salem, has announced changes in its representatives. Brooks Equipment Co., 636 Potrero St., San Francisco 10, Calif., is the new West Coast representative and, as such, carries a complete line of Quick-As-Wink control valves. The firm has branch offices in Portland, Ore., and Seattle, Wash., Marc E. Mercer, who formerly represented Hunt in northern California, has taken a new territory, the State of Wisconsin. He is now operating under the name of The Mercer Co., with quarters in Room 225, 512 E. Michigan St., Milwaukee.

LaVerne E. Cheyney, formerly section manager in the chemical products development division of the Goodyear Tire & Rubber Co., Akron, has joined the staff of Battelle Memorial Institute, Columbus, where he will be associated with its division of organic chemistry and will specialize in rubber technology. Dr. Cheyney is well known in the fields of rubber, plastics, and packaging materials. During the war he served as a member of the National Research Council Advisory Panels on Thin Films and Coatings to the Army Quartermaster Corps. He has taught courses in rubber at the University of Akron and in plastics at the Goodyear Industrial University. He is the author of a number of technical papers and bulletins on synthetic rubber and plastics and is the patentee of eleven U. S. and several foreign patents. A graduate of the University of Akron, Dr. Cheyney received his M.S. from the University of Pennsylvania and Ph.D. from Ohio State University. He is affiliated with the Division of Rubber Chemistry of the American Chemical Society, the Society of Plastics Engineers, Sigma Xi, and Phi Lambda Upsilon.

Sales, Service Forces Increased

Expansion of sales forces and extension of services provided customers to keep pace with expanded production facilities have been announced by The Mansfield Tire & Rubber Co., Mansfield. The company is providing new merchandising services to its customers to assist them in reaching post-war objectives in passenger and truck tire sales, according to G. W. Stephens, president and general manager.

A new director of merchandising, a new manager of the technical division, an assistant general sales manager, a new district sales manager, nine new special truck tire sales representatives, and a new service engineer have been added to carry out this program.

The assistant general sales manager is Edward E. Stevens, recently returned after 3½ years with the U. S. Navy. He comes to Mansfield Tire as assistant to J. S. Wainright, general sales manager, after 15 years in newspaper editorial and sales fields.

Director of merchandising is S. E. Shepard, formerly sales manager of the Raybestos Division of the Raybestos-Manhattan, Inc., Bridgeport, Conn. He has been identified with the automotive industry for 24 years.

The manager of the technical division is L. M. Baker, formerly manager of the technical division of the Lake Shore Tire & Rubber Co., Des Moines, Iowa. He was associated with the Firestone Tire & Rubber Co. for 10 years before joining Lake Shore.

Charles F. Orr, Jr., sales engineer at Mansfield Tire for three years, following 15 years in the tire and tube construction development department, is a new district sales manager, covering an area embracing Tennessee, Alabama, Georgia, and Florida.

New special truck tire sales representatives include: Hal C. Smith, operating under J. W. Boncer, district sales manager, for the area comprising southern New York, New Jersey, eastern Pennsylvania, Delaware, Maryland, and the District of Columbia; Charles P. Sniffen, Jr., working under J. W. Kearns, district sales manager, for the area comprising northern New York and New England; Richard R. Holten, under Walter J. Gray, district sales manager, covering Utah, Nevada, Idaho, Washington, Oregon, and California; N. C. Rundio, under Carl B. Gibson, district sales manager, covering Illinois, Iowa, Missouri, Nebraska, Kansas, Wyoming, and Colorado; O. C. Alexander, operating under Mr. Orr; H. A. Beatty, under E. L. Swanson, district sales manager, Wisconsin, Minnesota, North Dakota, South Dakota, and Montana; R. C. Boone, under R. K. Houston, district sales manager, Arkansas, Louisiana, Texas, Oklahoma, New Mexico, and Arizona; F. D. Winfield, under D. S. Rainey, district sales manager, West Virginia, Virginia, North Carolina, and South Carolina; Walter C. Leo, under F. D. Boals, district sales manager, Ohio, Michigan, Indiana, Kentucky, and western Pennsylvania.

Eugene H. Almy has been appointed service engineer under E. A. Porter, service manager. Employed in the experimental department before he entered the Army, Mr. Almy's new duties will entail checking service conditions in the field.

Buys Nebraska Factory

The Goodyear Tire & Rubber Co., Akron, has purchased the two-story factory in Havelock, Lincoln, Neb., in which, during the war, the company built airplane bullet-sealing fuel cells. Machinery and equipment necessary for the manufacture of V-belts, and belting for farm combine, tractor, straw baler, corn husker, and other types of farm machinery is ordered, and it is expected that the plant, following a reconditioning and maintenance program, will be in full operation within six months. When operations begin, between 400 and 500 persons will be employed in the factory's 172,650 square-foot U-shaped building area, which has been supplemented by the purchase of an additional 17 acres adjoining the present site.

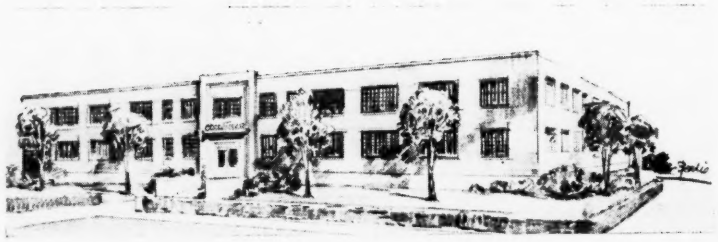
Those Goodyearites who will continue with the reorganized plant include R. W. Young, manager of materials and merchandise control; E. P. Murphy, personnel manager; W. C. Becket and J. C. Carter, division foremen; A. L. Mull, plant engineer; and A. T. Imes, works accountant. Appointment of the plant superintendent will be announced later.

The Goodyear plant was first occupied by the company in December, 1943, and known as its Lincoln division. Its workers were largely women. The plant was located in Lincoln because of nearness to the large airplane manufacturing factories which used the fuel cells in the planes they manufactured.

Three further steps in Goodyear's program of expansion were announced last month by P. W. Litchfield, chairman of the board: (1) creation of the chemical products division, with C. P. Joslyn as manager; (2) construction of a $1,000,000 chemical products division development laboratory; and (3) construction of a $3,000,000 plant for the conversion of vinyl chloride copolymers and other resins into films, sheets, etc. Ground has already been broken in Akron for construction of the new laboratory and sales office, and the new conversion plant is now in the design stage and expected to be under construction within a few months. These new developments are in addition to the Research Laboratory built in Akron in 1943 at a cost of $1,325,000, and the chemical plant built at Niagara Falls in 1945 at a cost of $1,500,000 for the production of vinyl chloride copolymers and related resins. The Research Laboratory will confine itself to the creation of new materials in the field of natural rubber, synthetic rubber, and plastics; while the problem of utilization of the new materials will be handled by the new chemical products division development laboratory.

The new laboratory is a two-story U-shaped structure of brick and stone. It has laboratory space for about 75 scientists, as well as necessary space for clerical work. In addition it will house the chemical products division sales force and the engineers of the chemical engineering division, a group concerned with pilot plant design and operation.

The new chemical products division development laboratory is concerned with four major functions, according to R. P. Dinsmore, vice president in charge of research and development. These are product development, sales development, technical sales service, and production technical service. Mr. Joslyn states that the sales development program has been divided into four chief fields: Pliofilm; plastics and coatings; Airfoam; and builders' supplies and floorings. Goodyear scientists have recently developed methods of compounding Pliofilm with a large number of modifying agents so that the resultant series of films vary through a wide range of characteristics, thus allowing choice of the proper packaging composition for each application. New uses seen for Pliofilm in addition to packaging include the weaving of Pliofilm thread into fabrics that can be used wherever a washable fabric is desirable, as in shoes, seat coverings, luggage, and many other products. Equally important uses are seen by Mr. Josyln for the vinyl chloride copolymers which can be made into transparent films or thick sheets, or used to coat paper or cloth, insulate wires, and even as a packaging material. Some of the new vinyl chloride copolymers developed by Goodyear can be processed like rubber and used in applications requiring a rubber-like material resistant to oil and sunlight.



Architect's Drawing of New Goodyear Chemical Products Division Development Laboratory

C. W. Walton has been named manager of the new laboratory. During the war, Dr. Walton directed the transition to production of the method for converting the polymerization of GR-S from a batch operation to a continuous operation, effecting a 50% increase in the potential capacity of the government's synthetic rubber plants.

Goodyear is expanding production of Neolite shoe soles to include soles for the shoe repair market. According to H. L. Post, manager of the shoe products division, the release of more leather soles has not slowed down the demand for Neolite, which, upon request of shoe manufacturers, is now being supplied in colors, including black, brown, natural, red, and white. Neolite was introduced to the shoe repair trade for women's shoes last September, and early this year will be available to shoe repair shops for all types of shoes. Produced under a secret formula, Neolite is said to have a uniform quality, to maintain a firm platform for foot protection and walking comfort, to hold the shoe in shape, to stay straight on the edges, and is waterproof and as light in weight as leather. It can be stitched or cemented, and it possesses workable qualities said to meet with favor in shoe factories and repair shops.

Property responsibility and custody of Hoosier Ordnance Plant, large wartime powder bag-loading unit, near Charlestown, Ind., has been returned to the federal government by Goodyear Engineering Corp., a subsidiary of Goodyear Tire, according to Roland H. Gray, resident manager. The plant superintendent, H. R. Child, has been transferred back to Akron to serve as superintendent of the production service division of the parent plant. Operated by Goodyear since ground was broken for its buildings in the Spring of 1941, the ordnance plant hung up an enviable record in speed, production, savings, and safety.

Completion of its 375,000,000th pneumatic tire in 44 years of production marked another milestone in January for Goodyear. The tire, a 6.00-16, four-ply passenger car casing, was built at the company's plant in Akron. With the discontinuation of tire rationing, special emphasis is now centered on the production of tires for civilian use. The shortage of passenger-car tires will continue throughout 1946 with 66 million casings needed for the year, according to R. S. Wilson, vice president in charge of sales and recent Director of Rubber Programs.

Personnel Changes

George J. Belhumeur, section head of interplant relations at Goodyear's Plant 1, has been named night superintendent at the company's Jackson, Mich., tire plant.

R. B. Bogardus has returned as assistant to J. J. Blandin, manager of crude rubber purchasing for Goodyear, after nearly four years in Washington, D. C., with the Rubber Development Corp., most recently as vice president in charge of Latin American operations.

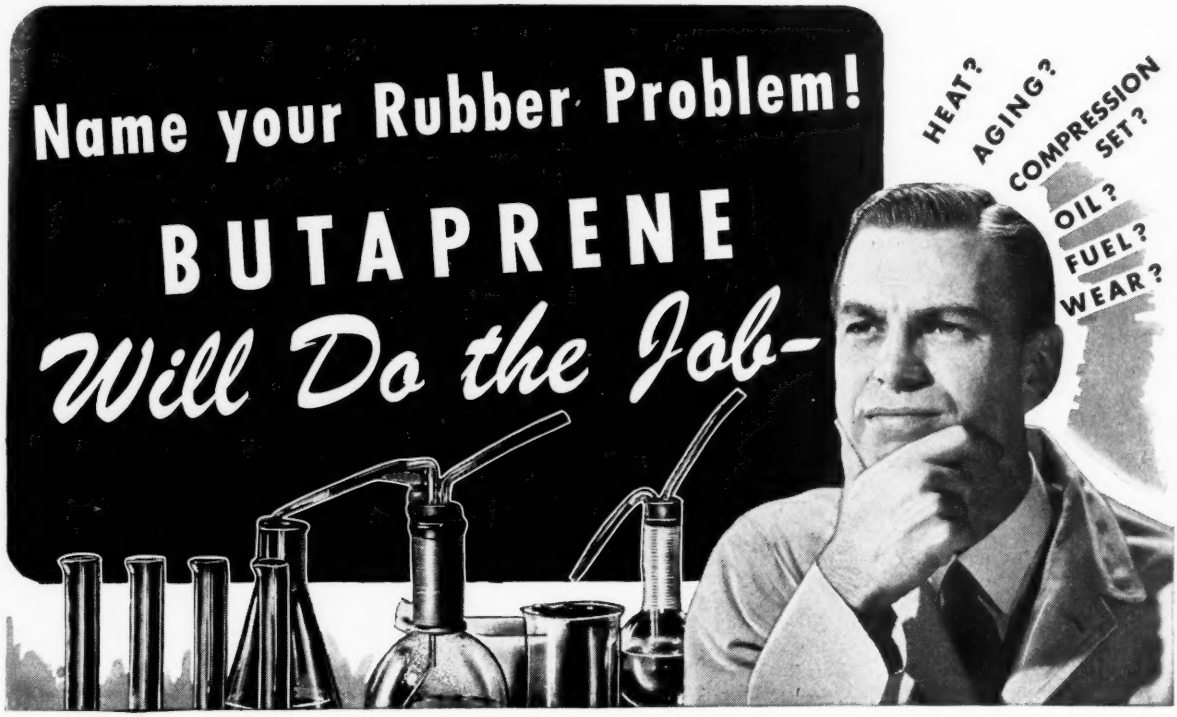
Frank J. Carter, personnel manager at Goodyear Aircraft Corp. since 1942, has been made director of personnel at the parent company to succeed Robert S. Pope, who has been assigned to as yet unnamed duties at the Goodyear plant in Los Angeles, Calif., where he had formerly been personnel manager. New personnel manager at the Aircraft plants is Paul F. Scheiderer, who had been assistant personnel manager since July, 1944.

H. E. Williamson, a 20-year veteran of Goodyear's tire sales division at Madison, Wis., has been transferred to the Pliofilm packaging sales department. Mr. Williamson, who will continue to make his headquarters at Madison, will serve as a packaging specialist, reporting to J. B. Post, manager of Pliofilm sales in the Chicago district. Mr. Williamson's first assignment is to assist L. H. Jones in the rapidly expanding market in the cheese industry.

R. T. Hickcox, former member of the Goodyear Research department, has been assigned to the Los Angeles sales

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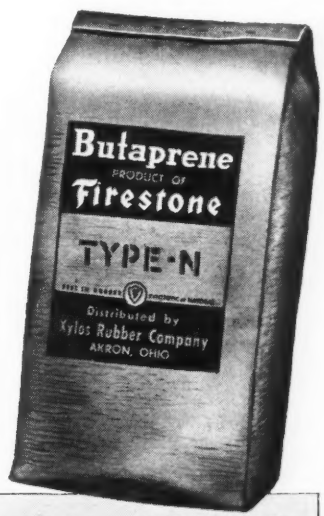


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offices of the company representing the plastics and coatings department of the chemical products division. A native of Riverside, Calif., and a graduate of the University of California with a chemical engineering degree, Mr. Hickcox joined Goodyear at Los Angeles in 1938, transferring to Akron in 1941 to the research laboratories. His work has included textile testing, factory process testing, research on non-metallic bullet-sealing fuel tanks, low-pressure laminating resins, methods for casting transparent resin sheets, and studies of low-density plastic cores for monoque structures.

Henry Watts has been appointed purchasing agent of Goodyear's plant in Uitenhage, South Africa. For the past four years he had been section head of a purchasing department at Goodyear Aircraft.

Two additional men have been assigned to the Goodyear factory in Brazil. W. J. Smith, who will serve as division B superintendent, was department foreman of final fitting and testing at Aircraft Plant D until he was transferred to the Gadsden, Ala., factory a few months ago. H. E. Schroeder will be manager of technical service in Brazil; he was formerly assistant manager of Aircraft Plant D's engineering shop. After a home leave in Akron, E. C. Ross last month returned to Brazil, where he is foreman in the company's textile plant.

Returned servicemen are finding places of responsibility in the expanding postwar program of Goodyear's chemical products division. Thus in the Pliofilm department, Atlanta district, now are J. S. Brewster, a sales representative and formerly a captain in the AAF, and T. D. Strickland, Jr., formerly a lieutenant commander in the Navy, as a specialist in vegetable packaging. E. J. Hill, a major with the U. S. Army Ordnance at Kelly-Springfield, Cumberland, Md., has joined Goodyear's plastics and coatings staff in Detroit, handling Michigan territory. Ray Earhart, captain of an armored infantry company in the European theater, has been placed in the sales training staff with headquarters in Akron; while James E. Snyder, a lieutenant colonel in the Army, has been assigned to the development department in charge of work on packaging materials, applications, and equipment.

Vernon H. Jones, manager of the dealer store planning and display department, in the January issue of *Display World Magazine* is selected as "display man of the year" with tribute paid to the establishment of Goodyear's visual merchandising laboratories under his leadership.

The Dayton Rubber Mfg. Co., Dayton, has named as executive vice president Bert R. Prall, former vice president and general manager of operations of Montgomery Ward & Co., Chicago, Ill., with which he had been associated for the past 26 years. The office of chairman of the board of the Dayton company will be left vacant, and its duties will continue to be combined with the office of President A. L. Freedlander, who is chief executive officer and general manager of the company.

Thomas Retires; H. Firestone, Jr., Reelected President

At the annual meeting of the board of the Firestone Tire & Rubber Co., Akron, on January 19, the retirement of John W. Thomas as chairman of the company was revealed as well as the reelection of Harvey S. Firestone, Jr., eldest son of the founder of the company, as president of the organization. No new chairman was named.

Mr. Thomas, who reached the age of 65 last November, retired from active management on his thirty-eighth anniversary with the company. He will, however, continue as a director and as honorary chairman, acting as consultant and adviser, with offices in the new Firestone research laboratories. Mr. Thomas, who joined the company in 1908, became a director in 1916, a vice president in 1919, president in 1932, and chairman in 1941.

At the Firestone board meeting all directors were reelected: Messrs. Thomas and Firestone, Lee R. Jackson, John J. Shea, James E. Trainer, Harvey H. Hollinger, and Russell A., Leonard K., Raymond C., and Roger S. Firestone.

Other officers elected are: Mr. Jackson, executive vice president; Mr. Shea, vice president and treasurer; Mr. Trainer, vice president in charge of production; Harold D. Tompkins, vice president in charge of sales; Mr. Hollinger, secretary; Claude A. Pauley, comptroller, Russell Firestone, Elton H. Schulenberg, and Wm. D. Zahrt, assistant treasurers; Henry S. Brainard, assistant secretary; and Timothy F. Doyle and Laurence A. Frese, assistant comptrollers.

At the annual stockholders' meeting held in New York on January 22, Mr. Thomas reported that the company has about completed reconversion to peace production and that by mid-March its tire plants should be operating at capacity producing more passenger-car and truck tires than ever before.

Mr. Firestone, Jr., who is also general chairman of the State of Ohio for United Service Organizations, last month was presented an Award for Distinguished Service by Lindsley F. Kimball, president of USO. The award was in the form of a certificate "in recognition of distinguished service to the nation through United Service Organizations." Mr. Firestone, who has served as Ohio State Chairman for USO since 1941, has devoted much of his time and his energies to USO clubs, councils, and other operations throughout Ohio.

Firestone developed a 5.50-15 size tire, to be produced on a worldwide basis, which has been engineered and designed especially for the lighter and more economical cars that several automobile manufacturers plan to produce within a short time. In keeping with the innovations to be incorporated into these new cars, Firestone, with the cooperation of several of the car manufacturers, has developed the 5.50-15 to provide a lower center of gravity and maximum safety at the minimum cost per mile. Now in production in all Firestone plants in this country, the new tire has a wider and flatter tread design which, it is said, will give a greater area of road contact, with resultant longer mileage.

The DeVilbiss Co., Toledo, has developed a new synthetic rubber hose reenforced with Fiberglas inner braid, through which hot plastic paint can be run at temperatures of 300° F. The hose is now being supplied to the Navy and has possibilities for wide civilian application. The Navy uses this hose to deliver hot plastic paint for spraying operations on ships' hulls to minimize barnacle growth. Fiberglas reenforcing for the hose was selected after many tests because of its high tensile strength and heat resisting qualities, according to Emil F. Frey, assistant sales manager for DeVilbiss. The new hose, reenforced with two inner braids of neoprene-coated Fiberglas yarn, has a minimum bursting pressure of 2,000 pounds per square inch, while the hot paint is forced through the hose by compressed air at a pressure of 100 pounds, which allows an adequate margin of safety. The hose, ½-inch inside diameter, will withstand maximum temperatures up to 400° F., according to Donald J. Peeps, DeVilbiss, chief engineer.

The Sun Rubber Co., Barberton, has introduced a new Sunruco rubber finger pad as part of its line of rubber office specialties. This pad has a fully grooved inside surface which allows air to circulate throughout and yet holds snugly to the finger. Other features include an 100% grip working surface and a shorter envelope to permit complete freedom of finger action.

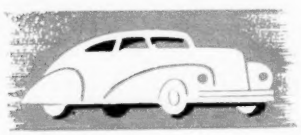
Erecting Research Center

The B. F. Goodrich Co., Akron, broke ground on January 3 for a new and complete research center, with construction to be started shortly. This announcement was made as the company observed the seventy-fifth anniversary of its founding. In the evening, at an assemblage of company personnel and Akron citizens at the Akron Armory, a birthday cake with 75 lighted candles was unveiled, and John L. Collyer, president of the company, gave a brief address on the problems and opportunities that lie ahead.

The new research laboratories will be erected on a 260-acre tract almost exactly halfway between Akron and Cleveland, near Brecksville. Present plans call for five separate completely air-conditioned buildings built of gray brick. According to Howard E. Fritz, director of research, the outstanding characteristic of the new laboratories will be the adaptability for rapid conversion from one type of work to another. Removable partitions, interchangeable fixtures, and a wide variety of special services will be employed. The main research laboratory and headquarters for basic research will be a T-shaped building, three stories tall, which will include 81 individualized laboratories, a cafeteria and dining room, an assembly room seating 250 people, and an extensive technical library. The second building, also three stories tall, will house physical testing, chemical engineering research, complete shops, receiving and store rooms, and necessary power units. A special high-pressure building, equipped with barricades and instruments for safety, will be provided in which chemical reactions can be tested. There will

You'll see  more of it...

You'll hear  more of it...and you may

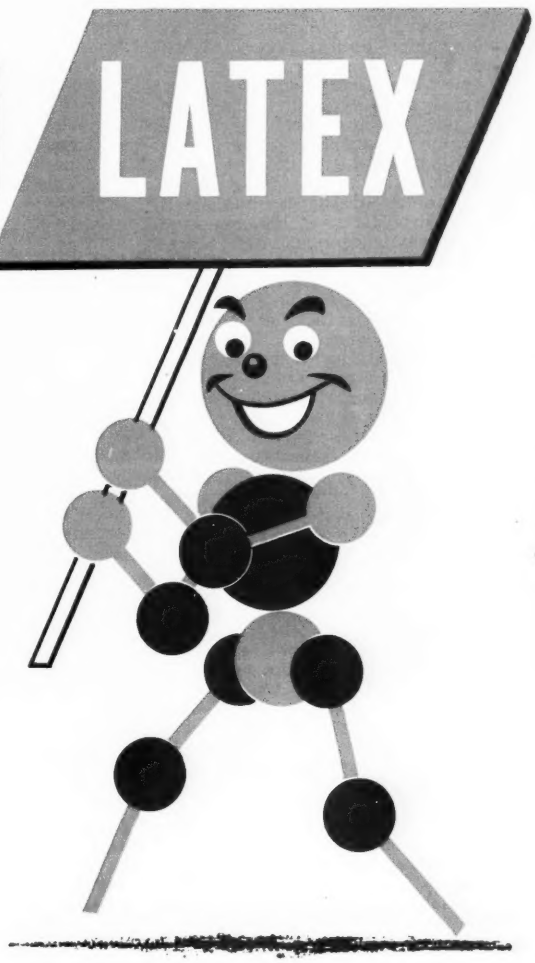
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THE NEWEST PERBUNAN POLYMER!

Properties of Latex Type Perbunan	"G"	"H"
Color (Visual Observation)	Cream	Cream
Per cent Total Solids (Evaporation)	52	55
Per cent Dry Rubber Content	50	52.5
Per cent Ash (On Total Solids)	0.23	1.10
PH	9.7	9.4
Latex Density at 25°C	0.978	0.981
Surface Tension dynes per cm, at 25°C	40.8	37.0
Mechanical Stability*	2.2	0.1
Absolute Viscosity Centipoises at 26.5°C	10.6	12.9

*Determined by running on high speed Hamilton-Beach stirrer operating at 10,000 rpm for 3 minutes. Value expressed as per cent coagulate based on dry rubber content of sample.



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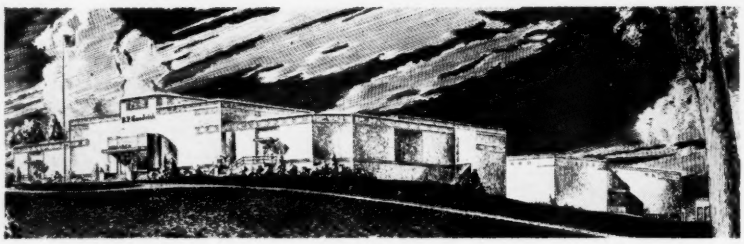
THE SYNTHETIC RUBBER THAT RESISTS OIL, COLD, HEAT AND TIME

STANCO DISTRIBUTORS, INC., 26 Broadway, New York 4, N.Y.; First Central Tower, 106 South Main Street, Akron 8, Ohio; 75 East Wacker Drive, Chicago 1, Illinois. West Coast Representatives — H. M. Royal Inc., 4814 Loma Vista Avenue, Los Angeles 11, California. Warehouse stocks in New Jersey, Illinois, California and Louisiana.

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also be a highly ventilated building for research work in toxic materials, and a separate building for storage of solvents.

At the outset of operations the staff will consist of between 220 and 250 persons, Dr. Fritz said, and emphasized that the plans allow for almost unlimited additions and expansions, either by enlarging the buildings already scheduled or by adding additional structures.



Architect's Drawing of Proposed Goodrich Research Laboratories

Other Goodrich News

A new cold room in which rubber and synthetic rubber compounds, plastics, and other materials can be tested at temperatures down to -90° F. has been installed at the Akron Goodrich plants. Temperatures in the room can be varied from 50 above to 90 below zero Fahrenheit. Thirty feet long and 15 feet wide, the cold room has five working units, each six feet square, cooled by a three-stage compressor unit and a single stage compressor using Freon 12 and 22 as refrigerants. Each unit operates separately, with electrically controlled temperatures charted for a 24-hour study at different levels. Capable of taking a load of 250 pounds of rubber or plastics, 500 pounds of steel, or 100 pounds of oil, each unit is equipped with a door having a non-locking catch and an alarm operated from within the unit as further protection against locking in the operator. Four of the units have temperature ranges from 50 to -65° F.; while the fifth has a range from 50 to -90° F. The new unit, the latest development in the company's research program on low-temperature testing, is large enough to permit tests of equipment under temperatures found in the colder parts of the continent as well as those encountered in high-altitude flying.

The constant tire-pressure device will probably never be used for postwar automobiles, say Goodrich engineers. The device was proved workable during the war when it was installed in amphibious ducks. Not only does it provide instant information about tire pressure while rolling, but also the means for inflating and deflating tires to any desired level without even slowing down. The convenience of such control on tire air pressure for automobile use would not be anywhere near worth the cost and the machinery necessary to make it possible, it was stated.

Potential world production of 3,000,000 tons of rubber annually, or more than twice the estimated annual consumption of 1,500,000 tons, was characterized by John L. Collyer, Goodrich president, as contributing to the complicated world surplus rubber problem. Speaking at the 1946 annual meeting of the Society of Automotive Engineers, January 7 to 11 at Detroit, Mich., Mr. Collyer recommended the accumulation of a natural rubber stockpile, the maintenance of operating condition in synthetic rubber plants, the production of at least 200,000 tons of synthetic rubber regardless of economic factors, and the expansion of rubber uses and consumption as interrelated factors for solution of this problem. Mr. Collyer favored encouraging the restoration of natural rubber production by an initial Far East price of 18½¢ per pound, with reduction to about 12¢ as soon as possible. The speech was taken from Mr. Collyer's "Rubber! Where Do We Stand? Where Are We Going?" published by Goodrich on November 1, 1945.

Four out of every ten passenger-car wheels in this country will be rolling on recapped tires in 1946, especially during the first half of the year, according to James J. Newman, vice president of the company, who stressed the danger of wearing present tires down beyond the point where they can be recapped, as it may be nearly a year before sufficient new tires may be available to all. The camelback recapping material now available is Grade A synthetic rubber, which is vastly superior to the material used in the first wartime recaps and actually delivers 90% as much mileage as would come from top-grade natural rubber. Tire dealers' inventories are very low, and the estimated demand for 73 million tires in 1946 to meet original-equipment and replacement needs will severely task the industry's production facilities, but still not provide for any substantial building up of inventory. More than 70 million recaps have been put on passenger-car tires since Pearl Harbor, according to Goodrich estimates. The rate of recapping is expected to stabilize eventually on a definitely higher level than before the war. For trucks and buses there will be a much greater rise in the tire building and recapping field.

Joseph A. Hoban, merchandise manager of the replacement tire division, addressed members of the Minneapolis Implement Dealers' Association during their annual convention on January 10. The title of his talk was "The Job Ahead as Applied to Rubber on the Farm." Mr. Hoban pointed to the need of close cooperation between agriculture and industry and the further mechanization and electrification of farms. He outlined the sales opportunities available in the farm market, and in addition to the pent-up demand for implements and tires he predicted the appearance on the market of many new rubber products, including the endless band track and a rubber mattress or floor covering for stables. Figures from a recent survey in Texas indicated that 83% of the farmers want to buy truck and equipment tires and 45% want tractor tires. These same figures are believed to be true throughout the nation.

Major R. E. Roseveare, who left his post as assistant general manager of Goodrich International Rubber Co., Manila, to fight when the Japs invaded the Philippines, has received the Silver Star. He will rejoin the International division about May 1 and after a short stay in Akron will return to Manila to the post he left when war came.

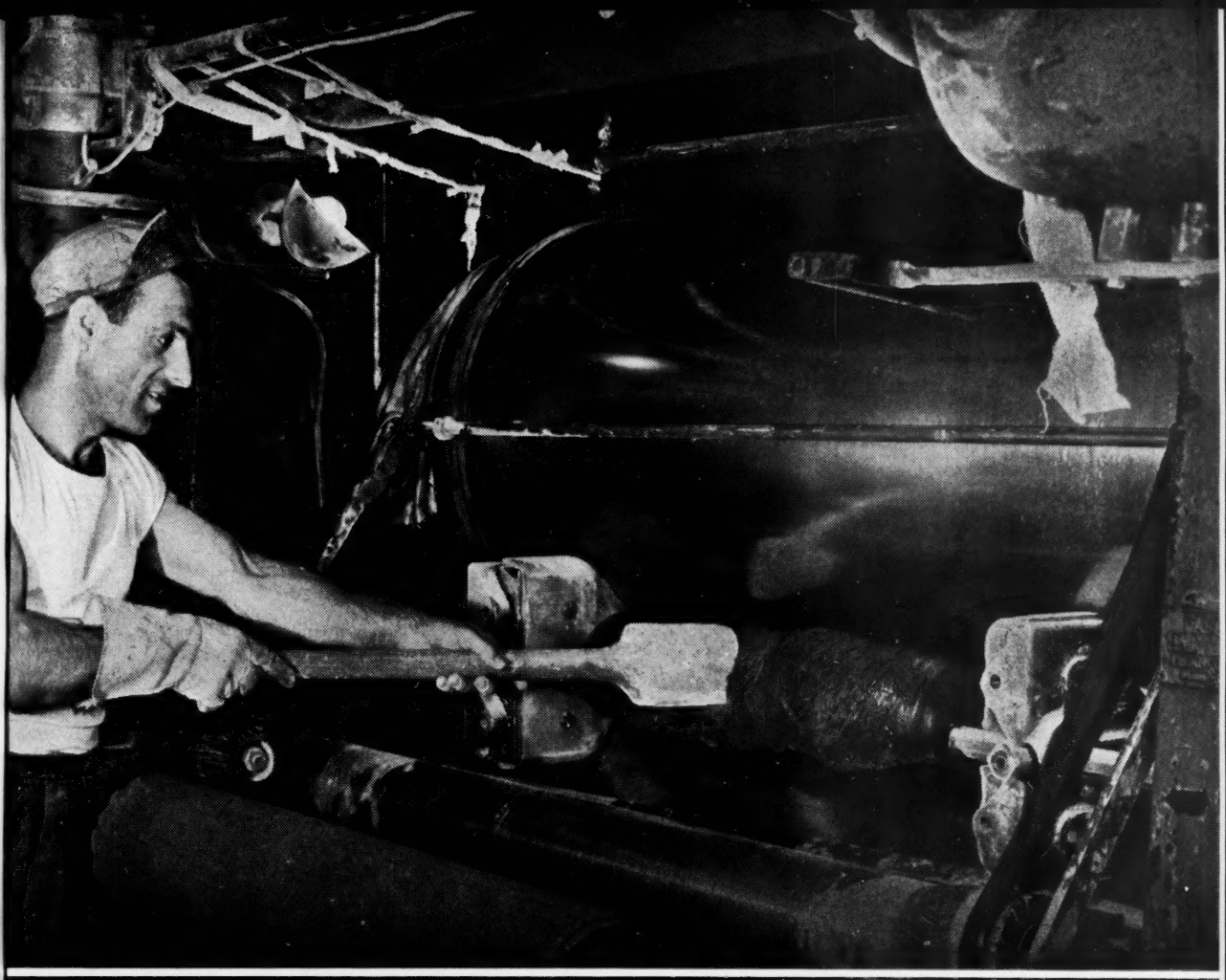
MIDWEST

Plaque Presented

At a ceremony at Flat River, Mo., on January 6, Governor P. M. Donnelly, on behalf of the mine, mill, and smelter workers of the St. Joseph Lead Co., presented a silver plaque of the Missouri state seal to the battleship *Missouri*. The 30-pound plaque, cast from silver mined in the company's southeast Missouri lead mines, was designed by Paul Manship and executed by the Gorham Co. It was accepted for the battleship by her commanding officer, Capt. R. H. Hillenkoetter. Officers of the St. Joseph Lead Co. presiding at the ceremony included Clinton H. Crane, president, I. H. Cornell and E. V. Peters, vice presidents, and Andrew Fletcher, vice president and treasurer. Among the approximately 10,000 spectators was a delegation of officers and men from the battleship. Special messages were received from President Truman and Navy Secretary Forrestal. The plaque was placed on exhibition in St. Louis, Mo., on January 7 and 8 and in New York, N. Y., on January 10 through 14.

The Meyercord Co., manufacturer of decalcomania, 5323 W. Lake St., Chicago 44, Ill., has reported that its technical consultation service, utilizing the know-how resulting from nearly 50 years of decalcomania production and research, again is available to advertisers and other commercial users. Their services devoted to Army and Navy work since the outbreak of the war, the company's technicians, who developed decals resistant to heat, oil, pressure, cold, and abrasion for the Armed Services, have been released for civilian study and consultation. The Meyercord laboratories also have been turned over to civilian research. Meyercord technicians have solved literally thousands of problems for decal users, from how to make freezeproof instruction signs for stratosphere planes, through water-shedding decals for trucks, to acid- and fume-proof decalcomania for the metal industries. The technical consultation service now is available through all the Meyercord branch offices in 30 cities in the United States and foreign countries.

The Superior Type Co., Chicago, Ill., has changed its name to Superior Marking Equipment Co., in order better to suggest its function as manufacturer of a complete range of marking devices.



More RESILIENCE FOR GR-S

CIRCOSOL-2XH . . .

Gives High Resilience in GR-S Vulcanizates

In hundreds of rubber plants, Sun's new processing aid, Circosol-2XH, is being used in compounding for tires, sheeting, mechanical goods, boots, soles, heels. Here are some comments, typical of the results being obtained:

"**Circosol-2XH** produces the proper softness of GR-S stock in the uncured state with full allowance for high resilience in the finished vulcanizate."

"**Circosol-2XH** produces ideal frictioning with minimum discoloration-troubles. There is no blooming whatsoever."

"**Shrinkage** is held to a minimum."

"**Neutral** in curing."

For more resilience, for more elasticity in your GR-S products, for greater resistance to flex-cracking, heat build-up, and wear, get the full story on Circosol-2XH. Call the Sun man near you for your free copy of "Circosol-2XH, an Elasticator." Or write . . .

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INDUSTRIAL PRODUCTS

Monsanto Advances Several

Monsanto Chemical Co., St. Louis, Mo., last month announced several executive promotions. Edward W. Gamble, Jr., for several years a sales and administrative executive of New York brokerage and investment banking houses and during the war an officer of the OSS, has been made sales assistant to Monsanto President Wm. M. Rand.

Herbert F. Weaver succeeds Edward A. O'Neal, Jr., as production manager of the company's phosphate division and in turn is succeeded as manager of the Anniston, Ala., plant by J. Fred Reeves, assistant plant manager.

Mr. O'Neal has been promoted to the position of deputy managing director of Monsanto Chemicals, Ltd., London, wholly owned subsidiary of the St. Louis concern.

A. T. Beauregard, manager of the elemental phosphorus plant at Monsanto, Tenn., has been transferred to St. Louis as special assistant to R. R. Cole, vice president and general manager of the phosphate division. Assigned to Mr. Beauregard's former position is John L. Christian, formerly assistant plant manager at the Tennessee operations.

Forrest M. Luckett has been appointed branch manager of the organic chemicals division office in Cincinnati, with territory including southern Ohio, northern Kentucky, and most of West Virginia. Mr. Luckett has been with Monsanto since 1924, when he joined the service departments. He became a special products salesman in the Chicago office in 1937, where he worked, except for a brief period in St. Louis, until his present appointment. The Cincinnati office, in Carew Tower, is under direction of J. R. Morehead of Monsanto's phosphate division.

T. C. Tupper is now stationed in Monsanto's organic sales division office at Cleveland. His territory will be northern Ohio, which is under Monsanto's organic chemicals division products branch office at Detroit, managed by William Russell. Mr. Tupper, who joined the company as a salesman in 1933, was discharged from the Army late last year after five years' service. He was a captain in cavalry.

Monsanto's plastics division, Springfield, Mass., has set up a packaging materials sales department under the direction of R. C. Evans. Since the introduction of Vuepak in 1938, the company has been active in the packaging field, carrying on wartime research and producing heat-sealing coatings for metal foil composites. The new sales group will concern itself with all major uses of plastic resins alone and in conjunction with paper metal foil, paper board, and transparent sheets in packaging.

Yale Rubber Mfg. Co., with a plant at Yale, Mich., and a branch at 1433 Holden Ave., Detroit, through President E. H. Henderson has announced a program of expansion in its new products development division under the supervision of Clinton Braidwood, one of the developers of Agripol. Following graduation from Michigan State College, Mr. Braidwood joined the United States Rubber Co. and later was associated with Reichhold Chemicals, Inc., as assistant director of research on surface coatings; he also did extension work with ester plasticizers.

Hewitt Rubber Corp., Buffalo, N. Y., exhibited for the first time its new latex foam material, Restfoam, at the recent Chicago Furniture Show.

N. S. C. Rubber Section Awards and Elections

The Firestone Tire & Rubber Co., Akron, O., became the first in the rubber industry to win the Distinguished Service Award of the National Safety Council on a company-wide basis. According to J. E. Trainer, vice president of the company, the outstanding safety record achieved by the Firestone plants saw the various units reduce their overall accident frequency by 47.8% for the year ending November 1, 1945; while the Akron plants achieved a 57.3% reduction in accident frequency. The Safety Council records reveal that the accident frequency in the Firestone plants was 45.2% below the average for the entire rubber industry and 27.9% below the average for all industry.

Trophy winners in the National Safety Council's Rubber Section Safety Contest were: The B. F. Goodrich Co. plant at Port Neches, Tex.; the United States Rubber Co. Ball Band Plant, Mishawaka, Ind., and the plant in Worcester, Mass.; The Lobl Mfg. Co., Middleboro, Mass.; the Fabric Fire Hose Co., Sandy Hook, Conn.; and Van Cleef Bros., Chicago, Ill. Certificates of Merit were awarded to the U. S. Rubber plants at Torrance, Calif., Indianapolis, Ind., Institute, W. Va., and the Naugatuck Footwear Plant, Naugatuck, Conn.

Members of the Rubber Section, National Safety Council, elected to the executive committee for 1945-1946 are as follows: general chairman, J. E. Lovas, U. S. Rubber, Passaic, N. J.; vice chairman in charge of program, Roland Kastell, U. S. Rubber, New York, N. Y.; secretary, Glen D. Cross, Firestone, Akron; *News Letter* Editor, H. L. Andrews, Firestone, Akron; engineering committee, George Burkhardt (chairman), General Tire & Rubber Co., Akron, Gordon Trank, Hewitt Rubber Corp., Buffalo, N. Y., Stanley A. Wright, General Motors Corp., Dayton, O.; health committee, J. Newton Shirley (chairman), Arrow Mutual Liability Insurance Co., Chestnut Hill, Mass., M. A. Thompson, U. S. Rubber Reclaiming Co., Buffalo, and Grant Shibley, Goodyear Tire & Rubber Co., Akron; membership committee, J. E. Croushore (chairman), Lakeshore Tire & Rubber Co., Des Moines, Iowa; publicity committee, F. W. Melcher (chairman), National Synthetic Rubber Corp., Louisville, Ky.; statistics committee, R. L. Wampler (chairman), Dayton Rubber Mfg. Co., Dayton, O.; staff representative, F. A. Van Atta, National Safety Council, Chicago, Ill.

Paul Van Cleef, retiring general chairman, announced that the membership of the Rubber Section had been increased by 17 companies during the year ending November, 1945, and the membership now represents one-third of the rubber companies in the country and includes all of the largest ones.

OBITUARY

Earl L. Mefford

EARL L. MEFFORD, 58, manager of The Goodyear Tire & Rubber Co.'s western division in Los Angeles, Calif., died on December 30 in Long Island, N. Y., after several months' illness. Mr. Mefford started with Goodyear as a tire salesman in 1918, after which he founded the E. L. Mefford Tire Co., Lima, O., and served as president and manager. He then returned to Goodyear in a managerial capacity. He had been manager for the Toledo, Columbus, Cleveland, and New York sales districts. In 1943 he was named assistant to the vice president in Washington, D. C. The following year he was assigned to the position he held until his death.

Funeral services were held January 2 at Ripley, O. Executives of the Goodyear company acted as pall bearers.

Mr. Mefford leaves two daughters.

Frank M. McGeary

FRANK M. McGEARY, head engineer (materials) of the Research and Standards Branch, Bureau of Ships, Navy Department, died of angina pectoris on December 18 in Washington, D. C.

Born November 18, 1881, in Kennerdell, Pa., Mr. McGeary's formal education ended with high school. He was largely self-educated through wide reading and various correspondence school courses in engineering and scientific subjects. He became foreman of the testing laboratory of Cambria Steel Co. in 1906. In 1910 he entered the employ of the Navy, starting as an assistant inspector of engineering material. The deceased advanced through the various grades of the inspection service at Cincinnati, Milwaukee, and Chicago, finally transferring to the Bureau of Engineering (predecessor of the Bureau of Ships) in Washington, D. C., in 1922.

Mr. McGeary was active in standardization work in the fields of packings and gaskets, heat insulation, and refractories. He was a member of the Masonic organization and represented the Bureau of Ships at A.S.T.M. meetings.

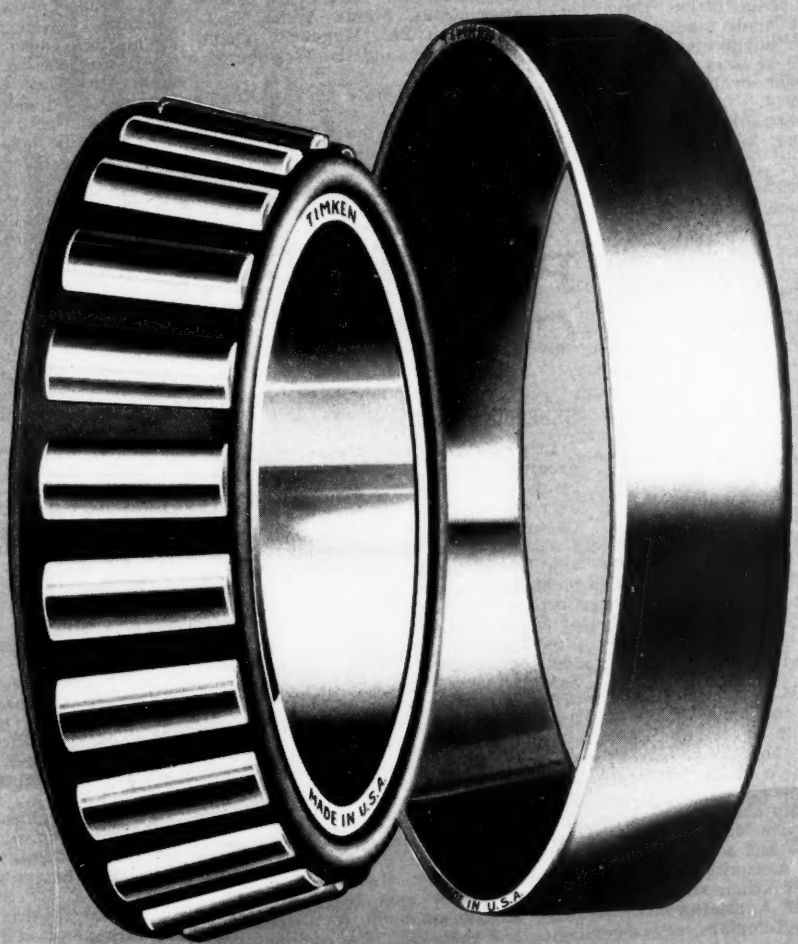
Funeral services took place on December 20 at Hines Funeral Home in Washington.

Mr. McGeary is survived by nine children and six grandchildren.

James M. Conway

JAMES M. CONWAY, 47, president of the Bishop Gutta-Percha Co., 420-30 E. 25th St., New York, N. Y., died December 19. He began his career with the company in 1916 and with the exception of the period when he was in the army in the first World War he was with Bishop continuously until his death. He was elected president in April, 1943; previously he had been assistant to the president of the Bishop company.

Mr. Conway is survived by a sister.



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Walter Gussenhoven

FORMER general manager of the mechanical goods division of United States Rubber Co., New York, N. Y., Walter Gussenhoven, died at his home in Ridgewood, N. J., on January 21 after a lingering illness. A native of Laramie, Wyo., where he was born January 25, 1878, Mr. Gussenhoven began his career with the company in 1899 as a tire salesman in New York. In 1913 he became mechanical goods salesman in the Chicago office; three years later he was made manager of that branch. Other advancements followed, and in 1927 he was given the position that he held until his retirement in August, 1944.

Funeral services were held in Ridgewood on January 24, followed by private interment.

He leaves a wife, a son, two brothers, and a sister.

Elmer F. Brunner

NATIONALLY known for his work in developing farm tires for the Goodyear Tire & Rubber Co., Elmer F. Brunner, died on January 5 in Cleveland, O., following an illness of several months.

Born in Salem, O., February 5, 1890, he received his education at Canton, O., Technical School, and in 1913 received his Mechanical Engineering degree from Carnegie Tech. He joined Goodyear in 1913 and became interested in farm tire development when Goodyear began experimenting in that line in 1930. He was placed in charge of Goodyear's farm tire development department in 1935, where he was responsible for the design of the product and equipment and for contact with tractor manufacturers and field operations.

During the war Mr. Brunner served as a consultant for the WPB Office of Rubber Director, the War Food Administration, and the Tractor War Emergency Committee of the Society of Automotive Engineers.

He was membership chairman of the SAE Tractor and Farm Machinery Engineering Committee and a member of the agricultural sub-committee of The Tire & Rim Association, Inc., the American Society of Agricultural Engineers, the Knight Templars, and the Shrine.

Funeral services were held January 8 in Cuyahoga Falls, with burial in the Crown Hill Cemetery at Twinsburg, O.

He leaves a wife, five daughters, three grandchildren, his mother, three brothers, and three sisters.

Lester G. Budlong

LESTER G. BUDLONG, in charge of patent work for the United States Rubber Co., died January 6, at his home in Mount Vernon, N. Y., after a long illness.

Born August 29, 1893, in Clarksville, Iowa, Mr. Budlong was graduated from Harvard University's School of Engineering in 1916. After serving in World War I as a lieutenant in the Army Medical Corps, he attended the College of Law at George Washington University and received a degree in patent law.

Prior to coming to U. S. Rubber, he served as assistant examiner at the United States Patent Office and as patent attorney for the Westinghouse Electric Corp. He joined the rubber company in 1929 as an assistant attorney in the patent department. After 1937 he managed patent affairs as a member of the staff of Arthur, Dry & Dole, company attorneys.

Mr. Budlong belonged to the American Patent Law, the New York Patent Law, and the New York State Bar associations, Sigma Alpha Epsilon, Sigma Nu Phi, Huguenot Yacht Club, the Masons, and the Westchester Power Squadron.

Funeral services were held in Mount Vernon on January 9,

Survivors include the widow, a son, a daughter, and his mother.

PACIFIC COAST

Shell Chemical Incorporated

In preparation for a large expansion program, Shell Chemical Corp. was recently incorporated in Delaware to take over and continue the business of Shell Chemical Division of Shell Union Oil Corp. J. Oostermeyer, president of the new concern, who made the announcement January 3, said Shell Chemical Corp. will be a wholly owned subsidiary of Shell Oil Co., Inc., 50 W. 50th St., New York 20, N. Y. The head office of the new concern is in the Shell Bldg., San Francisco, Calif., and a New York office will be maintained at 500 Fifth Ave.

In acquiring the business formerly conducted by Shell Union's chemical division, the new corporation will continue operation of the three chemical plants in California at Shell Point, Martinez, and Dominguez, and later will take over operation of Shell Oil's chemical plant in Houston, Tex. The major products now being manufactured include ammonia, fertilizers, solvents, and chemicals. The company will also continue operation of a butadiene plant at Torrance, Calif., for the Office of Rubber Reserve.

The board of directors is composed of Mr. Oostermeyer, A. E. Lacomble, W. P. Gage, L. V. Steck, and J. W. Watson, all of San Francisco. Other officers elected for the new corporation are: Messrs. Gage and Steck, vice presidents; Mr. Watson, treasurer; J. Rysdorp, secretary; P. T. Vockel, assistant treasurer; and J. M. Selden, Jr., assistant secretary.

The corporation will employ approximately 2,000 people. Its future activities will be directed toward the further development of petroleum derivatives throughout the country.

W. J. Voit Rubber Corp., Los Angeles, Calif., has announced that its DRI deck tennis rings, production of which was suspended during the war, are again available.

NEW ENGLAND

Acquires Hodgman Saran Division

The American Hard Rubber Co., New York, N. Y., has acquired the entire Saran division of the Hodgman Rubber Co., Framingham, Mass., following a decision by American Hard Rubber, by no means a newcomer to the Saran field as it was one of the earliest licensees under the Dow patent, to expand its facilities and extend its field of plastics manufacturing. This extension will not only include Saran, but Tenite, Lucite, polystyrene, and other thermoplastics.

The new Saran division of American Hard Rubber will be headed by S. J. Smith, a chemical engineer, who has been with the company for a good many years and was previously connected with the chemical equipment sales. Mr. Smith plans new lines to be added as opportunity presents and as new answers are found to old problems both by the industries and in the research laboratories maintained by the American Hard Rubber Co.

Athol Mfg. Co., Athol, Mass., on January 25 concluded a three-day meeting of manufacturing and sales executives. E. A. Clare, president, announced that discussions were centered particularly around the allocation of markets and new applications of synthetic resins and Terson plastic coatings developed during the war period.

Cambridge Rubber Sales Corp., Cambridge, Mass., has appointed George Eckstein branch manager of its New York, N. Y., office. For the past 15 years he had been with the New York office of Tyer Rubber Co., Andover.

Pequanoc Rubber Co., reclaimed rubber manufacturer, Butler, N. J., has moved its Boston, Mass., office to Room 203, but in the same building as formerly at 31 St. James Ave., and still under the charge of H. P. Fuller, New England sales representative.

Tire Rationing Ends in Canada

Tire rationing in Canada ended January 1 after having been in effect four years. End of rationing was announced in Ottawa, Ont., on December 26 by Hon. C. D. Howe, Minister of Reconstruction, who coupled a warning that stocks might prove insufficient to meet all immediate demands. However he said that Canadian production is picking up steadily, and he expressed confidence that normal conditions would be restored rapidly if the public cooperated during the first few months by buying tires only when necessary.

Following Mr. Howe's announcement, William Funston, president, Firestone Tire & Rubber Co., Ltd., Hamilton, Ont., estimated that it would take at least 1,000,000 tires to fill all requirements of Canadian motorists.

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APPLICATION

United States

2,388,674. **Diving Suit.** J. W. Browne, Waukesha, assignor to Diving Equipment & Salvage Co., Inc., Milwaukee, both in Wis.

2,388,701. **In a Method of Constructing Shell-Form Structures, the Use of an Inflatable Member Secured to a Suitable Foundation.** W. Neff, Los Angeles, Calif.

2,388,710. **Annular Gasket of Flexible, Yieldable Material in a Valve.** H. W. Sanford, Knoxville, Tenn.

2,388,835. **Resilient Masking Element to Protect the Interior of a Housing from Paint or Plating Material.** J. E. Duggan, Birmingham, Mich.

2,388,915. **Nursing Nipple.** H. Heilborn, Brooklyn, N. Y.

2,388,925. **In a Seal between a Shaft and a Casing, a U-Shaped Circular Housing Adapted to Be Secured to the Casing, and in the Housing, a Resilient Packing Ring.** W. Messinger, Philadelphia, Pa.

2,389,002. **In a Visor Assembly for an Automobile Window, a Sash of Rubber-Like Material to Receive the Window Pane.** G. W. Schatzman and A. P. Fergueson, assignors to Houdaille-Hershey Corp., all of Detroit, Mich.

2,389,114. **Welt Insole and Sewing Rib of Stitch Retaining, Permanently Pliable Synthetic Plastic Material.** W. C. Wright, Brookfield, N. H., assignor to Wright-Batchelder Corp., Boston, Mass.

2,389,118. **In a Pressure Vessel Closure, a Compressible Cylindrical Gasket.** H. A. Buehner, assignor to A. O. Smith Corp., both of Milwaukee, Wis.

2,389,134. **Elastic Member in a Fluid Control Device.** C. A. Brown, assignor to Dole Valve Co., both of Chicago, Ill.

2,389,210. **Airplane Wing or Fin with Improved Airfoil Characteristics Having a Metal Body with Projecting Rivet Heads, the Surface of at Least the Forepart of the Body Carrying a Coating of Natural or Synthetic Sponge Rubber in Which the Rivet Heads Are Embedded.** E. C. Pitman, Red Bank, N. J., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

2,389,223. **Eyeshield Including a Moldable and Relatively Inelastic Frame to Which Is Attached an Exuansible Diaphragm.** M. M. Werner, Brooklyn, N. Y.

2,389,253. **In a Bearing Having an Elongated Tubular Barrel and a Flange at One End Thereof, a Barrel Portion of a Non-Metallic Molded Bearing Composition.** T. L. Gatke, Oak Park, Ill.

2,389,273. **Slacks with Elastic Parts.** M. E. Novak, Chicago, Ill.

2,389,293. **Inhalant Hood Having Flat Sidewall Members of Resiliently Elastic Sheet Material.** J. A. Blosser, Oakland, Calif.

2,389,299. **Elastic Band in a Magnetic Apparel Closure.** R. Ellis, Belleville, N. J.

2,389,313. **Shield Assembly for an Air Scoop.** W. H. Hunter, Akron, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,389,362. **Miniature Baby Bathing Cot.** A. M. N. Harper, Jacksonville, Fla.

2,389,414. **Protective Foot Cover Including a Knit Body Having Heel and Toe Portions and a Relatively Narrow Shank; the Heel Seat and Counter Are Impregnated with a Solidified Resilient Rubber-Like Material.** W. E. Crofut, Jr., Beachwood Village, O.

2,389,430. **Tire Structure.** E. Hajos, Jamaica, assignor to Ampat Corp., New York, both in N. Y.

2,389,562. **In a Flexible Mounting Device with a Housing Formed by a Pair of Cup Members, a Pair of Rubber Bushings Arranged in the Housing.** H. A. Storch, Fairview Village, assignor to Harris Products Co., Cleveland, both in O.

2,389,592. **Relay Structure Having an Enclosing Shell of a Non-Magnetic Material, a Ceramic Insert in One End of the Shell, and Wedged between Shell and Insert, Elastic Resilient Sealing Means.** H. E. Bucklen, Jr., Elkhart, Ind., assignee of U. C. Hedin, Des Moines, Iowa.

2,389,641. **Composite Structure Consisting of a Base to Which a Body of Rubbery Material Is Bonded by Means of Two Primer Coats Containing Finely Divided Metal.** D. V. Sarbach, Cuyahoga Falls, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,389,690. **Cervical Collar Including Pneumatically Inflatable Members.** F. Schreiber, Detroit, Mich.

2,389,791-792. **Accumulator Having in Combination a Spherical Tank to the Interior of Which Is Secured a Similarly Shaped Inflatable Bladder.** W. A. Lippincott, Evanston, assignor to Ideal Roller & Mfg. Co., Chicago, both in Ill.

2,389,824. **Means for Clamping a Head upon a Hydraulic Actuating Cylinder and for Sealing the Head and Cylinder, including a Wedge-Shaped Resilient Sealing Element, Pivotally Mounted in a Groove in the Head.** T. R. Smith, assignor to Maytag Co., both of Newtown, Iowa.

2,389,831. **Prophylactic Sheath with Band of Waterproof Adhesive on Open Edge and Extending on the Inside.** S. J. Welsh, New York, N. Y.

2,390,033. **Cellulosic Fabric Fire Hose Treated with Acrylonitrile and then with a Solution of a Strong Hydroxide, which is Subsequently Removed.** J. W. Stallings, Haddon Heights, N. J., assignor to Rohm & Haas Co., Philadelphia, Pa.

2,390,134. **Ball Cock Valve Structure with a Rubber Valve Seat Member.** B. Svirsky, Glendale, Calif.

2,390,168. **In Combination, a Shaft on Which Is Arranged a Contractible Bushing, and a Single Solid Resilient and Plastic Interponent Encased Intermediate the Shaft and Bushing.** M. Piot, Roanne, France; vested in the Alien Property Custodian.

2,390,184. **For Interposition between a Wet Dressing and a Bandage, an Insert Consisting of a Non-Absorbent, Waterproofed Sheet with Spaced, Perforated Projections.** M. Seng, Berlin, Germany; vested in the Alien Property Custodian.

2,390,199. **Inflatable Life Raft.** J. A. Walsh, West Haven, Conn.

2,390,226. **Electric Motor-Driven Eraser.** J. P. Smith, Reidsville, N. C.

2,390,233. **In Association with a Sealed Flexible Air-Tight Aviator's Suit for High Elevations, a Breathing System Including a Mask, a Breathing Line, a Rebreathing Bag, and a Box Enclosing the Rebreathing Bag.** J. D. Akerman, Minneapolis, and W. M. Boothby, A. H. Bulbulian, and W. R. Lovelace II, Rochester, both in Minn.

2,390,290. **In a Resilient Wheel a Cushion Structure Consisting of a Pair of Resilient, Rubber-Like Elements to Adjacent Faces of Which Are Adhered a Pair of Plates.** J. D. Beebe, Silver Lake, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,390,311. **In a Hydraulic Brake Including a Brake Drum, Brake Blocks Adapted to Engage the Brake Drum, and Actuating Means therefor Consisting of a Grooved Cylindrical Member Backing the Brake Blocks, Resilient, Elastic Gaskets in the Grooves.** H. P. Kupiec and E. Stewart, Baltimore, assignors to Glenn L. Martin Co., Middle River, both in Md.

2,390,319. **Pressure Accumulator Including, a Shell with Open Neck through Which Can Be Inserted a Flexible, Baglike Membrane.** J. W. Overbeke, assignor to Simmonds Aerocessaries, Inc., New York, both of New York N. Y.

2,390,347. **Shoe Stiffener Including a Fabric Base Coated and Saturated with a Mixture of Resin and Wax Including Particles of a Polymerized Hydrocarbon of High Adhesive Quality Distributed throughout Its Surface and Protected at Normal Temperature by a Superficial Indurated Non-Adhesive Film of a Resin-Wax Mixture.** E. L. Beckwith, Brookline, and A. P. Swett, Westwood, both in Mass., assignors to Beckwith Mfg. Co., Dover, N. H.

2,390,445. **Oiltight Joint for Sealing Two Cylindrical Surfaces, Which Includes Two Annular Grooves and an Annular Rubber Compound Packing Member inside Both Grooves.** J. Mercier, New York, N. Y.

2,390,462. **Garment Construction Including Separable Sections, Having Elastic Portions at the Joints.** G. W. Rosenberg, Elkins Park, Pa.

2,390,485. **Shoe and Welt therefor Formed of Waterproof Plasticized Vinyl Resin or Like Material.** W. C. Wright, Brookfield, N. H., assignor to Wright-Batchelder Corp., Boston, Mass.

Dominion of Canada

431,472. **Goggle with a Unitary Form-Fitting Face Mask of Resilient Material.** American Optical Co., assignee of D. P. Bernheim and E. M. Splaine, all of Southbridge, Mass., U.S.A.

431,473. **Goggles with a Frame of Resilient Material.** American Optical Co., Southbridge, assignee of C. A. Baratelli, Cambridge, D. P. Bernheim, Southbridge, and W. Lown, Boston, all in Mass., U.S.A.

431,474. **Goggles Including a Single-Aperture Frame of Flexible and Resilient Material.** American Optical Co., Southbridge, Mass., assignee of W. H. Lehmberg, Riverside, Conn., C. A. Baratelli, Cambridge, and W. Lown, Boston, both in Mass., U.S.A.

431,506. **Double Window Pane Structure Having a Frame of Strip Material and a Spacer of Resilient Material between the Panes.** General Motors Corp., Detroit, assignee of C. F. Huddle, Ferndale, both in Mich., U.S.A.

431,507. **In a Double Window Pane Structure Having a Frame of Strip Material and Spacing Means between the Panes, a Compound Seal of Which One Constituent Provides a Water Dam and Is Asphalt, and the Other Securely Bonds the Parts together and Is Vinyl Acetate.** General Motors Corp., assignee of R. A. Richardson, both of Detroit, Mich., U.S.A.

431,517. **In a Resilient Mounting Having Members for Connection between a Load and a Support, a Sandwich Unit Having Opposed Plates Connected by a Resilient Element Such as Rubber.** Lord Mfg. Co., assignee of L. Wallerstein, Jr., both of Erie, Pa., U.S.A.

431,524. **In an X-Ray Tube Housing Including a Cylindrical Main Housing Member within the Open End of Which Lies a Cylindrical Closure Member, an Annular Gasket of Plastically Deformable Sealing Material between Parallel Flanges on the Members.** Picker X-Ray Corp., Waite Mfg. Division, Inc., Cleveland, assignee of E. R. Goldfield, University Heights, and E. B. Graves, South Euclid, all in O., U.S.A.

431,574. **Dental Plate Base of a Plasticizer-Free and Water-Insoluble Organic Ester of Cellulose of a Relatively Low Degree of Esterification.** C. Dreyfus, New York, N. Y., U.S.A.

431,576. **Dart Flight Formed of Polythene.** J. Hodkinson, Southampton, Hampshire, England.

431,582. **Wheel Cover of Resilient Deflectable Form Retaining Material.** G. A. Lyon, Allenhurst, N. J., U.S.A.

431,583. **In a Wheel Structure, a Hub Cap Formed with a Shoulder Having a Seat for a Trim Ring, and a Trim Ring of Rubber-Like Material.** G. A. Lyon, Allenhurst, N. J., U.S.A.

431,584-586. **For a Wheel Structure, a Cover Assembly Wholly or Partly of Resiliently Flexible Material.** G. A. Lyon, Allenhurst, N. J., U.S.A.

431,612-613. **A Laminated Article Including Sheets of Cellulose Fibers Impregnated with a Synthetic Resin, and an Amino Plastic Resin as Bonding Agent.** American Cyanamid Co., New York, assignee of K. E. Ripper, Bronxville, both in N. Y., U.S.A.

431,617. **Rubber-Like Cement for Attaching Soles to Shoes.** B. B. Chemical Co. of Canada, Ltd., Montreal, P. Q., assignee of M. W. Tetlow, Sharon, Mass., U.S.A.

431,667. **Hood Cap for Bottles, Etc., in Which the Margin Is Impregnated with a Solution of Benzol and Rubber.** Oswego Falls Corp., Fulton, N. Y., assignee of R. F. Huntley, Shaker Heights, O., and I. L. Wilcox, Fulton, N. Y., both in the U.S.A.

431,729. **In an Improved Method of Telescopically Coupling Pipes, Rods, Etc., a Flat Resilient Band Mounted on the Smaller Pipe.** W. Larymore, Mayfield, N. S. W., formerly of Kalgoorlie, and R. D. Kelly, Royal Australian Air Force, Western Australia, all in Australia.

431,747. **In a Pipe Coupling, a Tubular Band or Bands of Resilient Material.** W. Larymore, Mayfield, New South Wales, Australia.

431,748. **Vehicle Wheel Including a Plurality of Wooden Disks Mounted on a Hub, a Resilient Tire Mounted on the Periphery, and a Secondary Tire or Casing Retaining the Same in Position, and a Plurality of Tire Segments Positioned over the Secondary Tire.** J. A. Leask, Cranbrook, B. C.

431,750-755. **In a Cover Structure for a Wheel Including a Tire Rim Part and a Body Part Connected thereto, a Wheel Cover of Resilient Sheet Material.** G. A. Lyon, Allenhurst, N. J., U.S.A.

431,760. **A Fuel Injection Device Including a Casing, and a Valve Component therein Formed of a Compressible Plastic Material.** E. P. Paxman, Colchester, Essex, England.

431,770. **In an Oxygen Regulator for Aviators, a Valve with a Body Portion and an Envelope of Thin Soft Rubber Embracing the Body Portion; the Envelope Provides a Thin Soft Rubber Facing for the Seat-Engaging Surface of the Valve Body.** Air Reduction Co., New York, N. Y., assignee of G. M. Deming, Orange, N. J., both in the U.S.A.

431,771. **A Linear Polymer of Polybutene and a Filler, as Can End Lining Composition.** American Can Co., New York, N. Y., assignee of J. E. Robinson, Glen Ellyn, and F. H. Bopp, and P. W. Millelot, Jr., both of Maywood, both in Ill., both in the U.S.A.

431,816. **Resilient Lining for a Necktie.** Dimple Tie Corp., New York, assignee of H. and V. Naftali, both of Mount Vernon, both in N. Y., U.S.A.

431,826. **Power Transmission Belt Including a Body of Rubber-Like Material in Which Is**



S/V Product 2243 Forms Tough, Durable Surface Film that's Resistant to Abrasion

For both natural rubber and GR-S Compounds, you can count on S/V Product 2243 to stop deterioration caused by sun-checking.

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Embedded at Least One Tension Resisting Element. B. F. Goodrich Co., New York, N. Y., assignee of G. H. Stewart, Akron, and E. R. Traxler, Stow, both in O., both in the U.S.A.

431,884. **Dish-Shaped Washer for a Locating and Securing Device.** W. H. J. Brock, inventor, and Automotive Products Co., Ltd., assignee of one-half of the interest, both of Leamington Spa, Warwick, England.

431,891. **A Distortable Capsule for Cooperation with a Movable Clamping Element in a Fluid Operated Vice.** S. F. Burgoine and H. E. Elsden, both of Cheltenham, Gloucester, England.

431,899. **Clothes Wringer.** N. L. Etten, Waterloo, Iowa, U.S.A.

431,932. **In an Engine Starter a Power Shaft, a Barrel Member, a Flanged Member in the End of the Barrel a Flanged Nut within the Barrel, and a Cylinder of Elastically Deformable Material in the Barrel between Flange Member and the Flange of the Nut.** Bendix Aviation Corp., South Bend, Ind., assignee of J. E. Buxton, Elmira, N. Y., both in the U.S.A.

431,962. **Ice Cube Tray with Thin, Soft Rubber Lining.** Copeman Laboratories Co., Flint, assignee of H. B. Copeman, Metamora, both in Mich., U.S.A.

431,968. **Static-Free Brush with Bristles Having a Thin Coating of Conductive Rubber.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of L. Marick, Grosse Pointe Farms, Mich., U.S.A.

431,977. **Sealing Device for the Space between a Housing and a Shaft Including a Split, Centrally Apertured, One-Piece Molded Sealing Element of Oil-Resistant Rubber-Like Material Bonded to a Rigid Backing.** General Tire & Rubber Co., Akron, O., assignee of T. H. Winkeljohn, Wabash, Ind., U.S.A.

432,017. **Vehicle Tire.** Pennsylvania Rubber Co., Jeannette, Pa., assignee of A. C. Bowers, Akron, O., and C. M. DuPuy, Jeannette, Pa., both in the U.S.A.

432,039. **Seal of Rubber-Like Material for Sealing the Clearance Space between Two Interfitting Annular Members.** H. E. Jackman, Pensacola, Fla., administratrix of the estate of E. F. Jackman, now deceased, in his lifetime of Lakewood, O., both in the U.S.A.

United Kingdom

572,972. **Parachute Packs and Envelopes therefor.** A. H. Stevens (F. G. Manson).

573,002. **Flexible Electrical Conductors.** Callender's Cable & Construction Co., Ltd., Callender-Suchy Development, Ltd., P. V. Hunter, L. G. Brazier, and C. T. Suchy.

573,167. **Medical Syringes.** S. J. Everett.

573,231. **Fluid Seals for Shafts and Bearings, Etc.** H. Clayton-Wright.

573,307. **Aircraft Fuel Tanks.** B. Wilkinson and K. M. Le Good.

573,390. **Resilient Suspension Devices for Vehicles.** L. M. Ballamy and R. H. Sheepshanks.

PROCESS

United States

2,388,776. **Mold from Resilient Material United to a Rigid Backing.** E. H. Wallace, Detroit, Mich., assignor to United States Rubber Co., New York, N. Y.

2,389,038. **Bending Plastic Tubing.** M. German, Cozad, Neb.

2,389,459. **Applying a Thin Coating of an Adhesive Containing Rubber to Cord Fabric.** I. J. Remark, and V. V. Wheeler, assignors to General Tire & Rubber Co., all of Akron, O.

2,389,952. **Preparing a Loom Picker.** J. J. Brown, Newton Falls, assignor to Denman Tire & Rubber Co., Warren, both in O.

2,390,437. **Bristling and Stapling Articles Made from Polymerized Vinyl Aromatic Compounds.** R. F. Hayes, Springfield, Mass., assignor to Monsanto Chemical Co., St. Louis, Mo.

Dominion of Canada

431,555. **Coating Paper with a Benzene-Soluble Copolymer of Vinyl Chloride and Vinylidene Chloride.** Wingfoot Corp., assignee of A. J. Seitz, both of Akron, O., U.S.A.

431,559. **Tire Fabric from Cellulosic Yarns.** C. Dreyfus, assignee of W. Whitehead, both of New York, N. Y., U.S.A.

431,640. **Corrugated Tubes.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of W. G. Harding, Fair Lawn, N. J., U.S.A.

431,712. **Molding Articles from a Mass Consisting Predominantly of Water-Insoluble Thermoplastic Material, Including Chlorinated Rubber.** Winthrop Chemical Co., Inc., New York, N. Y., U.S.A., assignee of H. Pohle, Cologne-Muhlheim, and P. Weikart, Rath-Konigsforst near Cologne, both in Germany.

431,948. **Welding Ethylene Polymer.** Canadian Industries, Ltd., Montreal, P. Q., assignee of W. H. Driesen, Clifton, and M. M. Renfrew, Arlington, both in N. J., U.S.A.

United Kingdom

573,096. **Formation of Rubber Treads on Vehicle Tires.** L. F. Wallis.

CHEMICAL

United States

2,388,685. **Solid, Thermoplastic Products Flexible at —50° C., Obtained by Polymerizing Styrene in Aqueous Emulsion, adding Butadiene-1,3, and Polymerizing the Latter While in the Collodidal Solution.** C. O. Guss and R. W. Amidon, assignors to Dow Chemical Co., all of Midland, Mich.

2,388,765. **Terpene Ethers.** A. L. Rummelsburg, assignor to Hercules Powder Co., both of Wilmington, Del.

2,388,802. **Polyvinyl Ketal Acetal Resin Formed by the Reaction of a Hydrolyzed Polyvinyl Acetate with Methyl Ethyl Ketone and Butyraldehyde and a Plasticizer.** J. D. Ryan, Toledo, O., and F. B. Shaw, Jr., Baltimore, Md., assignors to Libbey-Owens-Ford Glass Co., Toledo, O.

2,388,834. **Maintaining the Concentration of Butadiene Cyclic Dimer in Furfural Used in Solvent Extraction of Butadiene at a Desirably Low Level by Distillation in the Presence of Water.** D. R. Douslin, Bartlesville, Okla., and C. F. Weinaug, Phillips, Tex., assignors to Phillips Petroleum Co., a corporation of Del.

2,388,846. **For Adhering Opposed Bituminous Surfaces, an Adhesive Consisting of a Coumarone-Indene Resin and a Nitroparaffin Solvent for the Resin.** M. H. Hecht, Allentown, assignor to Atlas Mineral Products Co. of Pa., Merztown, both in Pa.

2,388,851. **A Water-Soluble Resinous Material Which Becomes Insoluble in Water When the Water of a Solution Is Evaporated, and Is the Product of Deesterification of a Copolymer of Vinyl Acetate and a Mono Chloroallyl Ester of a Monocarboxylic Acid.** W. O. Kenyon and W. F. Fowler, Jr., assignors to Eastman Kodak Co., all of Rochester, N. Y.

2,388,905. **Increasing the Resistance of Rubber to the Usual Rubber Solvents by Adding Maleic Anhydride to Masticated Rubber, and Then Masticating in the Cold Long Enough to Effect a Reaction of the Rubber with the Maleic Anhydride.** P. H. M. Compagnon and J. N. L. Le Bras, both of Paris, France; vested in the Alien Property Custodian.

2,388,916. **Continuously Synthesizing Butadiene by Continuously Forming Acetylene in a Reaction Zone by Reacting Calcium Carbide with Steam at 700 to 1000° F., and Continuously Feeding Ethylene into the Zone Where It Contacts Nascent Acetylene.** C. H. Holder, Cranford, N. J., assignor to Standard Oil Development Co., a corporation of Del.

2,388,928. **Separating Butadiene from Acetylenes.** C. E. Morrell, Roselle, and M. W. Swaney, Linden, both in N. J., assignors to Standard Oil Development Co., a corporation of Del.

2,388,984. **Compositions for Producing Films Which, though Non-tacky at ordinary Temperatures, Are Capable of Heat-Sealing at Elevated Temperatures, Consisting of a Polyisobutylene, a Cyclized Rubber and a Wax.** G. P. Mack, Jackson Heights, assignor to Advance Solvents & Chemical Corp., New York, both in N. Y.

2,389,205. **Producing Diolefins by Contacting an Admixture of Monoolefin and Aldehyde with Activated Alumina at a Temperature between 500 and 750° F.** N. H. Marsh, Baytown, Tex., assignor to Standard Oil Development Co., a corporation of Del.

2,389,231. **Production of 1,3-Butadiene from 2,3-Dichlorobutane.** D. R. Blumer, Bartlesville, Okla., assignor to Phillips Petroleum Co., a corporation of Del.

2,389,354. **Cellulose Ether Plasticized by a Compound from the Group of Para-Tertiary Butyl Phenoxy Ethanol, Para-Tertiary Amyl Phenoxy Ethanol, and Para-Tertiary Butyl Phenoxy Ethyl Acetate.** W. E. Gloor, New Brunswick, N. J., assignor to Hercules Powder Co., Wilmington, Del.

2,389,370. **Plastic Composition Including Ethyl Cellulose and from 0.5 to 3% of a Catechol Having a Para-Mono Substituted Methyl Group, as Stabilizer therefor.** W. W. Koch, assignor to Hercules Powder Co., both of Wilmington, Del.

2,389,444. **Producing Styrene from a Hydrocarbon Mixture Containing Mono- and Poly-Ethylbenzenes.** W. J. Mattox, assignor to Universal Oil Products Co., both of Chicago, Ill.

2,389,445. **Mono Ethyl Benzene from Poly Ethyl Benzene.** W. J. Mattox and W. L. Benedict, assignors to Universal Oil Products Co., both of Chicago, Ill.

2,389,460. **Thermal Insulation Composition Consisting of Fibers Including Mineral Wool Fibers, Polyvinyl Resin Binder, and a Vaporizable Solvent Adapted to Form with the Binder a Colloidal Adhesive Gel.** H. H. Rinehart, Plainfield, N. J., assignor to Johns-Manville Corp., New York, N. Y.

2,389,465. **Making an Expander for Storage Battery Plates from Partially Neutralized Alkaline Lignin Containing Solution Derived from Wood.** A. Stewart, Mountain Lakes, N. J., and A. R. Pitrot, Hempstead, assignors to National Lead Co., New York, both in N. Y.

2,389,469. **For Adhesive Tape Coating, a Solution Including Rubber, a Resin, and Zinc Oxide in a Non-Aqueous Solvent, to Which Is Added a Small Percentage of a Water-in-Oil-Type Dispersion Agent.** F. J. Tone, Niagara Falls, O. L. Mahlman, Kenmore, and F. Brown, assignors to Carborundum Co., both of Niagara Falls, both in N. Y.

2,389,477. **Recovering a Resinous Product from a Solution of a Liquid Intermediate Methyl Polysiloxane Resin in Toluene, Treated with Antimony Pentachloride and a Hydrated Iron Chloride.** J. G. E. Wright, Alplaus, and J. Marsden, Schenectady, both in N. Y., assignors to General Electric Co., a corporation of N. Y.

2,389,489. **Plasticizing and Softening a Sulphur-Vulcanizable, Rubber-Like Copolymer of a Conjugated Diolefin and a Compound Polymerizable therewith by Mixing therewith an Alkyl-Thiosuccinate.** R. T. Dean, Stamford, and E. O. Hook, Darien, both in Conn., assignors to American Cyanamid Co., New York, N. Y.

2,389,576. **1,3-Butadiene-1-Phosphate Acid Esters of one to five Carbon Atom Alcohols.** G. M. Kosolapoff, Dayton, O., assignor to Monsanto Chemical Co., a corporation of Del.

2,389,626. **Synthesizing a Compound from the Group of Vinyl Halide and Hydrocarbon-Substituted Vinyl Halide.** W. A. Lazier, assignor to E. I. du Pont de Nemours & Co., Inc., both of Wilmington, Del.

2,389,658. **Continuous Method of Segregating and Concentrating Butadiene with the Aid of a Cuprous Chloride Solution.** E. V. Fasce and L. E. Pirkle, Baton Rouge, La., assignors by mesne assignments to Jasco, Inc., a corporation of La.

2,389,693. **Polymerizing Mixtures of Iso-Olefinic and Diolefinic Hydrocarbons Having four to six Carbon Atoms with a Friedel-Crafts Catalyst at Temperatures below -10° C. While the Catalyst Is Dissolved in Carbon Disulphide.** W. J. Sparks, Cranford, and R. M. Thomas, Union, both in N. J., assignors by mesne assignments to Jasco, Inc., a corporation of La.

2,389,708. **Coating Composition Containing Solid Granular Ethyl Cellulose Dispersed in a Liquid Vehicle Containing Material from the Group of Drying Vegetable Oils, Semi-Drying Vegetable Oils, and Alkyd Resins Modified with Such Oils.** J. J. Zolad, Detroit, Mich., assignor to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

2,389,780. **Converting Ethylene into Substantial Yields of Butylene by Reacting Ethylene in the Presence of a Calcined Composite Catalyst Including Silica Metallic Zinc, Alumina, and Zirconia.** V. N. Ipatieff and V. Haensel, assignors to Universal Oil Products Co., all of Chicago, Ill.

2,389,793. **Recovering Styrene from a Styrene-Containing Mixture Resulting from the Pyrolysis of Hydrocarbons.** J. W. Livingston, assignor to Monsanto Chemical Co., both of St. Louis, Mo.

2,389,794-795. **Wrinkle Coating Composition Including a Resin Resulting from the Reaction of Glycerol, Phthalic Anhydride, and Fatty Acids; a Top Drier and Hydrocarbon Diluent.** E. L. Luaces, Dayton, O., assignor to New Wrinkle, Inc., Wilmington, Del.

2,389,796. **Making Purely Aqueous Emulsions of Polyisobutylene Having an Average Molecular Weight above 27,000.** G. P. Mack, Jackson Heights, assignor to Advance Solvents & Chemical Corp., New York, both in N. Y.

2,389,801. **Forming Styrene Directly from Ethyl Cyclohexane by Dehydrogenating the Latter under a Pressure below Atmospheric Pressure in the Presence of a Dehydrogenerating Catalyst at 450 to 700° C.** W. J. Mattox, Riverside, assignor to Universal Oil Products Co., Chicago, both in Ill.

2,389,802-807. **Stabilizing Organo-Siloxanes.** R. R. McGregor, Verona, and E. L. Warrick, Pittsburgh, both in Pa., assignors to Corning Glass Works, Corning, N. Y.

2,389,837. **Coating Composition Including a Tough and Strong Resin Formed by the Reaction of Phthalic Anhydride, Glycerol, and Drying Oil Fatty Acids, Dissolved in a Normally Liquid Hydrocarbon Solvent.** C. Bogin, assignor to Commercial Solvents Corp., both of Terre Haute, Ind.

2,389,855. **Rubber Lubricant Composition Capable of Remaining in an Emulsified State When Allowed to Stand Undisturbed for Ex-**



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tended Periods of Time, Consisting of an Aqueous Emulsion Containing as Active Lubricating Ingredients a Fatty Acid, an Amino Hydroxy Compound, Bentonite, and Colloidal Graphite. H. G. Johnson, assignor to Commercial Solvents Corp., both of Terre Haute, Ind.

2,389,865. **Porous Ion Exchange Carrier Resin Resulting from the Reaction by Application of Heat in a Reaction Vehicle Containing Water of Phenol and Formaldehyde in the Presence of an Alkali Metal Hydroxide Condensing Agent.** G. F. Mills, Palo Alto, and A. V. Alm, Burlingame, assignors to Chemical Process Co., San Francisco, all in Calif.

2,389,958. **In the Process for Recovering Solid Chlorinated Polyvinyl Chloride from Solution in a Volatile Organic Solvent, the Step Which Includes Contacting the Solution with Steam in a Hot Aqueous Medium Containing a Small Amount of a Water-Soluble High Molecular Weight Colloid.** J. W. C. Crawford, Frodsham, and A. D. Jones, Widnes, both in England, assignors to Imperial Chemical Industries, Ltd., a corporation of Great Britain.

2,389,959. **Plasticizing and Softening Butadiene-1,3-Acrylonitrile Copolymer Materials by Admixing a beta-Substituted Oxypropionic Acid Ester of the Formula R-OCH$_2$CH$_2$COOR' Where R' Is of the Group of the Alkyl and Alkoxyalkyl Radicals, and R Is of the Group of the Alkyl, Alkoxyalkyl, Cycloalkyl, Aryl, Aralkyl, Aralkoxy-Alkyl and Tetrahydro-Furfuryl Radicals.** R. T. Dean, Stamford, Conn., assignor to American Cyanamid Co., New York, N. Y.

2,390,028. **Acrylic Acid Esters.** H. T. Neher and S. C. Kelton, Jr., both of Bristol, assignors to Rohm & Hass Co., Philadelphia, both in Pa.

2,390,035. **Treating Polymeric Vinylidene Chloride to Obtain a Cold-Workable Crystalline Product Which Is Substantially Haze-Free.** R. M. Wiley, assignor to Dow Chemical Co., both of Midland, Mich.

2,390,036. **Diaryl Guanidine Addition Products as Rubber Vulcanization Accelerators.** A. R. Davis, Riverside, Conn., assignor to American Cyanamid Co., New York, N. Y.

2,390,098. **Production of Lactonitrile by Reacting Hydrocyanic Acid with Vinyl Acetate in the Presence of an Alkaline Catalyst and Adding Acetaldehyde to the Reaction Mixture.** V. L. Hansley and J. E. Bristol, both of Niagara Falls, N. Y., assignors to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

2,390,153. **Solubilizing a Water and Organic Solvent Insoluble Nitrogenous Condensation Product of an Aliphatic Diamine Having at Least five Carbon Atoms and a Carbonyl Compound from the Group of Aldehydes and Ketones.** R. Kern, Ludwigshafen-on-the-Rhine, Germany; vested in the Alien Property Custodian.

2,390,164. **Resinous Product Obtained by Conjointly Polymerizing Vinyl Chloride and an Ester of Allyl Alcohol and a Saturated Monocarboxylic Acid.** E. W. Moffet, Milwaukee, Wis., and R. F. Smith, New York, N. Y., assignors to Pittsburgh Plate Glass Co., a corporation of Pa.

2,390,189. **Mastic Composition Including Fibrous Material and Hydrocarbon Resin Polymer.** F. J. Soday, Swarthmore, Pa., assignor to United Gas Improvement Co., a corporation of Pa.

2,390,190. **Mineral Fiber Mass of Open Structure Having a Coating Including a Hydrocarbon Resin Polymer from the Group of Heat Resin Polymer and Catalytic Resin Polymer of Polymerizable Hydrocarbons Contained in a Hydrocarbon Oil Physically Separated from Tar Produced in the Vapor Phase Pyrolysis of Petroleum Oil.** F. J. Soday, Swarthmore, Pa., assignor to United Gas Improvement Co., a corporation of Pa.

2,390,198. **Hardenable Composition Including the Heat Hardenable Condensation Product of a Phenol and an Aldehyde, in a State not Further Advanced Than the Resole State, and a Halogen Containing Interpolymerizate Obtained from Mixtures of Materials from the Group of Vinyl Chloride and Maleic Anhydride; Vinyl Chloracetate and Maleic Anhydride; Vinyl Acetate and Chloromaleic Anhydride; Styrene and Chloromaleic Anhydride.** A. Voss, deceased, late of Frankfort A. M., by H. Voss, administratrix, Frankfurt, A. M., and K. Dietz, Kronberg, and H. Thomas, Hofheim, all in Germany; vested in the Alien Property Custodian.

2,390,285. **Conversion of Hydrocarbons, Including Alkylation of a Mixture Containing Isobutane, Normal Butane and Olefins, Separating Normal Butane from the Products of Alkylation and Dehydrogenating It to Butadiene, in the Process of Which Small Amounts of Iso C$_4$ Hydrocarbons Are Also formed, Separating Butadiene and a Fraction Containing Normal Butane, Isobutane, Normal Butylene and Isobutylene, and Supplying at Least a Portion of the Last-Mentioned Fraction to the Alkylation Step.** G. B. Zimmerman, assignor to Universal Oil Products Co., both of Chicago, Ill.

2,390,368. **Para-Divinylbenzene.** C. A. Hochwalt, Dayton, O., assignor to Monsanto Chemical Co., St. Louis, Mo.

2,390,378. **Hydrolyzing a Mixture of Silicon Halides Including Methyl Silicon Halides.** J. Marsden, assignor to General Electric Co., both of Schenectady, N. Y.

2,390,422. **Producing a Coating Composition by Oxidizing the Surface of a Pellet of Finely Divided Particles of a Cyclized Rubber, Milling the Oxidized Pellet and an Anti-oxidant, and Dispersing the Milled Product in a Solvent.** C. M. Carson, Cuyahoga Falls, assignor to Wingfoot Corp., Akron, both in O.

2,390,446. **A Sulphur Vulcanized Composition Including a Furylethylene Polymer Plasticized with a Sebacic Ester and Reenforced with Carbon Black.** C. J. Mighton, assignor to E. I. du Pont de Nemours & Co., Inc., both of Wilmington, Del.

2,390,470. **Production of alpha, beta-Dichloropropionitrile by Reacting Anhydrous, Oxygen-Free Chlorine with Acrylenitrile in the Liquid Phase at 0 to 100° C. in the Presence of Visible Light and in the Absence of Oxygen and Water.** J. K. Sumner, Langhorne, assignor to Rohm & Haas Co., Philadelphia, both in Pa.

2,390,481. **Water-Insoluble Resinous Composition from a Water-Soluble, Naturally Occurring Gum Mixed with a Liquid Water-Soluble Condensation Product of Acetone and Formaldehyde.** T. C. Whitner, Elizabeth, N. J., assignor to Chemical Laboratories, Inc., a corporation of N. J.

Dominion of Canada

431,498. **Solid Elastic Products Resulting from Reacting Monomeric Unsaturated Nitriles with Unsaturated Elastomers.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of H. Romeyn, Jr., Detroit, Mich., U.S.A.

431,499. **Reclaiming Scrap Containing Vulcanized Polychloroprene by Heating in the Presence of Water at a Temperature between 300 and 420° F. in the Presence of an Amine.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of W. G. Kirby and P. M. Elliott, both of Naugatuck, Conn., U.S.A.

431,500. **Reclaiming Scrap Containing Elastic Polychloroprene by Mixing therewith Material Containing Cellulose Fibers and Heating in the Presence of Water, at a Temperature in the Range of 300 to 420° F.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of W. G. Kirby and L. E. Steinle, both of Naugatuck, Conn., U.S.A.

431,501. **Reclaiming Scrap Containing Vulcanized Polychloroprene by Heating at a Temperature from 300 to 420° F. in the Presence of an Acid of the Formula R-COOH, Where R Is from the Group H, OH, COOH and Aliphatic Hydrocarbon Groups Containing from one to 18 Carbon Atoms.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of W. G. Kirby and P. M. Elliott, both of Naugatuck, Conn., U.S.A.

431,502. **Reclaiming Scrap Containing Vulcanized Polychloroprene by Heating at a Temperature from 300 to 420° F. in the Presence of a Sugar.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of W. G. Kirby and L. E. Steinle, both of Naugatuck, Conn., U.S.A.

431,503. **For an Abrasive Article, a Bonding Agent Including the Vulcanization Product of a Mixture of Material from the Group of Copolymers of Butadiene-1,3 and Styrene, Copolymers of Butadiene-1,3 and Acrylic Nitrile, Sulphur, and a Copolymer of Isobutylene and a Conjugated Diolefin.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of C. E. Drake, Bloomfield, N. J., U.S.A.

431,522. **Preparing a Soft Plastic Vulcanizable Rubber-Like Copolymer of a Butadiene-1,3 Hydrobenzene and Vinyl Cyanide.** Monsanto Chemical Co., St. Louis, Mo., assignee of R. L. Sibley, Nitro, W. Va., both in the U.S.A.

431,598. **Oil-Soluble Phenolic Resins.** I. Rosenblum, New York, N. Y., U.S.A.

431,599. **Fusible, Soluble Phenol-Formaldehyde Condensates to Which Terpene Material Has Been Added.** I. Rosenblum, New York, N. Y., U.S.A.

431,615. **Liquid Adhesive Composition Including Butadiene-Acrylonitrile Copolymer Dispersed in an Appropriate Solvent, and as Toughener for the Copolymer, Pyroxylin.** B. B. Chemical Co. of Canada, Ltd., Montreal, P. Q., assignee of J. Teppema, Cambridge, and J. F. Manning, Boston, both in Mass., U.S.A.

431,616. **Liquid Adhesive Composition Including Butadiene-Acrylonitrile Copolymer and, as Toughener, a Copolymer of Vinyl Chloride and Vinyl Acetate.** B. B. Chemical Co. of Canada, Ltd., Montreal, P. Q., assignee of J. Teppema, Cambridge, and J. F. Manning, Boston, both in Mass., U.S.A.

431,634. **Can End Sealing Compound Including Thermoplastic Methacrylate Resin Polymer of an Ester of Methacrylic Acid Which Will Flow under Heat, and a Thermoplastic Modifying Agent from the Group of "Brewers Pitch" and Terpene Resins.** Crown Cork & Seal Co., Inc., assignee of A. H. Warth and W. C. Rainer, all of Baltimore, Md., U.S.A.

431,653. **Manufacture of Soluble Phenolic Resins Including Reacting Simultaneously a Phenol, an Aldehyde, and a Liquid Terpene Material with the Aid of a Reactive Chloride.** Libbey-Owens-Ford Glass Co., Toledo, O., assignee of I. Rosenblum, New York, N. Y., U.S.A.

431,788. **Bonded Laminated Magnetic Material in Which the Bonding Agent Is Composed of Polyvinyl Acetal, Polyvinyl Acetate, and a Heat Hardening Phenol Aldehyde Type of Resinous Condensate.** Canadian Westinghouse Co., Ltd., Hamilton, Ont., assignee of J. G. Ford, Sharon, Pa., U.S.A.

431,941. **Reducing the Adhesiveness of the Surfaces of Interlayer Sheeting Essentially Including Polyvinyl Butyral Resin and an Ester Plasticizer therefor, by Treatment with an Aqueous Solution Including an Acid from the Group of Hydrochloric, Hydrobromic, Hydrofluoric, Sulphuric, Nitric, Acetic, and Formic Acids.** Canadian Industries, Ltd., Montreal, P. Q., assignee of L. Paggi, Belleville, N. J., U.S.A.

431,942. **Polymerizing Vinyl Chloride in the Form of an Aqueous Emulsion in the Presence of a Water-Soluble Dispersing Agent from the Group of Salts of Pure Sulphonic Acids of Organic Compounds Containing at Least eight Carbon Atoms and Salts of Sulphuric Acid Esters of Organic Compounds Containing at Least eight Carbon Atoms, and Then Isolating the Polymeric Material by Adding a Water-Soluble Lead Salt.** Canadian Industries, Ltd., Montreal, P. Q., assignee of J. R. Lewis, L. B. Morgan, and J. T. Watts, all of Blackley, Manchester, England.

431,945. **Coating Composition Including a Vinyl Resin, part of Which Is a Vinyl Halide Resin, and a Soluble Condensation Product of Material from the Group of Urea, and Amino Triazines, with Formaldehyde and a Monohydric Alcohol.** Canadian Industries, Ltd., Montreal, P. Q., assignee of H. G. Stauffer, Drexel Hill, Pa., U.S.A.

431,947. **Protective Coating for Aluminum-Containing Surfaces Consisting of a Polymer of a Monovinyl Compound, and between Metal and Coating, a Layer Consisting of a Polymer of a Monovinyl Compound and a Substantially Insoluble Infusible Resin Formed in Situ by the Reaction of a Polyhydric Phenol and an Aldehyde.** Canadian Industries, Ltd., Montreal, P. Q., assignee of A. Hershberger, Kenmore, N. Y., U.S.A.

431,949. **Resin Obtained by Reacting with Formaldehyde in the Presence of an Alkaline Reagent Catalyst the Normally Solid Polymers Obtained by Polymerizing Carbon Monoxide with Ethylene.** Canadian Industries, Ltd., Montreal, P. Q., assignee of W. E. Hanford, Wilmington, Del., U.S.A.

431,966. **Rubber Molding Composition Consisting of Rubber, Sulphur, and a Hard Resinous Highly Purified Rubber Isomer.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of L. E. Daly, Osceola, Ind., U.S.A.

431,967. **As Antiflex Cracking Agent for Rubber, a Catechol in Which the Carbon Atom in the Para Position with Respect to a Hydroxy Group Is Attached to a Tertiary Group.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of R. T. Armstrong, New York, N. Y., and E. J. Hart, Cedar Grove, N. J., U.S.A.

United Kingdom

572,455. **Synthetic Resins and Coating Compositions therefrom.** Pinchin, Johnson & Co., Ltd., trading as Docker Bros., and G. F. Wilkinson.

572,475. **Vulcanizable Polymers from Diolefins.** Standard Oil Development Co.

572,574. **Rubber Derivatives.** British Rubber Producers' Research Association and F. Hilton.

572,575. **Oil Resisting Rubbers.** British Rubber Producers' Research Association and E. H. Farmer.

572,588. **Expanded Plastic Materials.** Expanded Rubber Co., Ltd., and A. Cooper.

572,767. **Polymerization Products from Polymerizable Organic Chlorine Products.** Distillers Co., Ltd., J. J. P. Staudinger and M. D. Cooke.

572,768. **Purification of Resinous Rubber Transformation Products.** Albert Products, Ltd., and S. R. W. Martin.

572,798. **Artificial Films and Filaments Having a Basis of Alginic Material.** J. B. Speakman, N. H. Chamberlain, and Cefoil, Ltd.

572,803. **Nitroethylene and Polymers Derived therefrom.** A. E. W. Smith, R. H. Stanley, C. W. Scaife, Imperial Chemical Industries, Ltd.

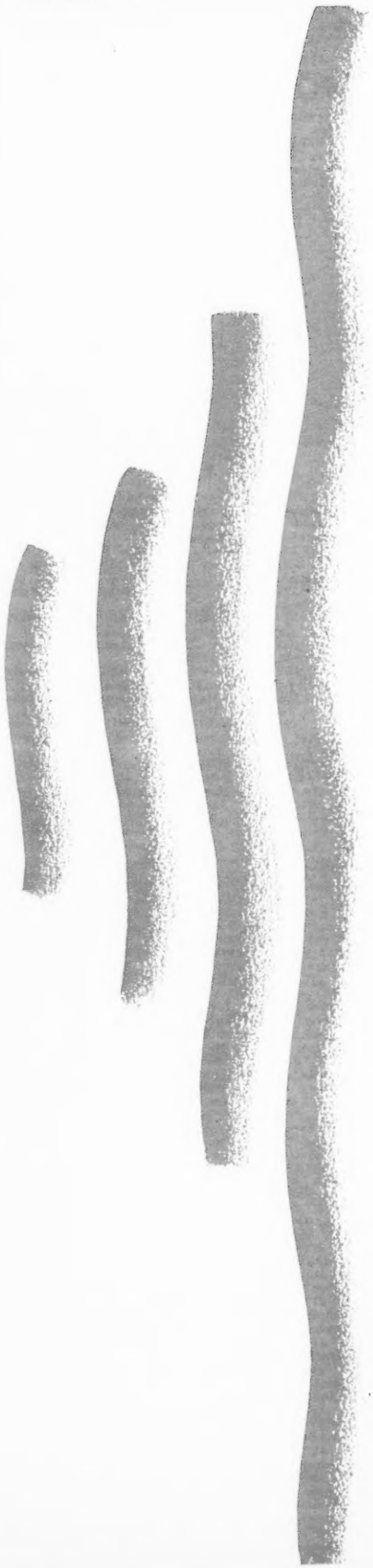
572,821. **Conversion of Butylenes and Pentenes to Diolefins.** C. Weizmann.

572,822-823. **Coating Compositions.** H. S. Lilley, J. W. Dorling, and Imperial Chemical Industries, Ltd.

572, 827. **Copolymers from Substituted Acrylonitriles and 1-3 Butadienes or Derivatives thereof.** Wingfoot Corp.

572,828. **Synthetic Resinous Condensation Products and Molding Compositions therefrom.** British Rubber Producers' Research Association and F. J. W. Popham.

572,829. **Resin Intermediates and Their Aldehyde Condensation Products.** American Cyanamid Co.



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572,830. **Emulsions or Compositions Containing Organic Polysulphides and Articles Produced therefrom.** Dunlop Rubber Co., Ltd., J. R. Blanco, A. E. T. Neale and D. F. Twiss.

572,857. **Synthetic Resins.** Distillers Co., Ltd., J. D. Morgan, and B. Frenkel.

572,858. **Synthetic Resins.** J. G. Fife (Shell Development Co.)

572,862. **Adhesive Compositions.** British Rubber Producers' Research Association and K. C. Roberts.

572,875. **Treatment of Polymeric Materials.** Wingfoot Corp.

572,878. **Polymers and Copolymers from Chloroacrylophenones.** Wingfoot Corp.

572,891. **Polymerized Nitroethylene.** A. E. W. Smith and Imperial Chemical Industries, Ltd.

572,910. **Vinyl Trimethylacetate and Copolymers thereof.** E. I. du Pont de Nemours & Co., Inc.

572,914. **Synthetic Resins.** E. I. du Pont de Nemours & Co., Inc.

572,919. **Soft Synthetic Rubber-Like Masses.** Monsanto Chemical Co.

572,923. **Compositions of Rubber or the Like and the Incorporation therein of Vulcanized Rubber or the Like.** Dunlop Rubber Co., Ltd., D. F. Twiss, and A. J. Hughes.

572,963. **Conversion of Vinyl-Type Halides to Aldehydes or Ketones.** Shell Development Co.

572,985. **Treatment of Plastic Surfaces.** Distillers Co., Ltd., J. J. P. Staudinger, and H. M. Hutchinson.

572,987. **Adhesive Composition.** Dunlop Rubber Co., Ltd., and A. A. Round.

572,989. **Condensation Products from Thiocyanates with Formaldehyde.** F. Frank, Aspro, Ltd., and British Artificial Resin Co.

572,997. **Separation of Diolefins from Gaseous Mixtures.** C. Weizmann.

573,016. **Polymerization of Styrene or Its Derivatives.** Bakelite, Ltd.

573,024. **Synthetic Rubber-Like Materials.** E. I. du Pont de Nemours & Co., Inc.

573,045. **Compositions of Organic Sulphides and Articles Produced therefrom.** Dunlop Rubber Co., Ltd., J. R. Blanco, A. E. T. Neale, and D. F. Twiss.

573,046. **Separation of Butadiene from Olefins.** Distillers Co., Ltd., W. L. Wood, H. M. Stanley, and W. P. Joshua.

573,049. **Rubber Derivatives and Synthetic Resinous Condensation Products Including Rubber or Rubber Derivatives.** British Rubber Producers' Research Association and F. J. W. Popham.

573,050. **Rubber Derivatives.** British Rubber Producers' Research Association and F. J. W. Popham.

573,053. **Reclaiming Vulcanized Rubber.** Dunlop Rubber Co., Ltd., and R. C. Davies.

573,054. **Reclaiming Rubber Containing Cellulosic Material.** Dunlop Rubber Co., Ltd., P. H. Amphlett, A. J. Hughes, and D. F. Twiss.

573,055. **Interpolymerization of Acrylonitriles.** Imperial Chemical Industries, Ltd.

573,062. **Emulsion Polymerization of Organic Materials.** Imperial Chemical Industries, Ltd.

573,083. **Synthetic Resins.** P. Lunt & Co., Ltd., and E. J. Lush.

573,086. **Production of Copolymers of Isobutylene by Emulsion Polymerization.** E. I. du Pont de Nemours & Co., Inc.

573,110. **Preserving Rubber and Other Oxidizable Organic Substances.** United States Rubber Co.

573,112. **Rubber-Like Materials.** Kenilworth Mfg. Co. and G. Shaffer.

573,114. **Resinous Condensation Products and Molding Compositions therefrom.** British Rubber Producers' Research Association and F. J. W. Popham.

573,115. **Molding and Thermoplastic Compositions.** S. A. Leader.

573,270. **Polymeric Materials.** R. G. R. Bacon, L. B. Morgan, and Imperial Chemical Industries, Ltd.

573,306. **Cellular Polymerized Ethylene.** Callender's Cable & Construction Co., Ltd., and G. M. Hamilton.

573,308 and 573,333. **Preparation, Treatment, and Application of Resins.** L. A. Jordan and J. K. Aiken.

573,339. **Pulverulent Preparations of Rubber-Like Condensation Products.** H. Taylor and Imperial Chemical Industries, Ltd.

573,366. **Polymerization of Vinyl Chloride.** R. G. R. Bacon, L. B. Morgan, and Imperial Chemical Industries, Ltd.

573,368. **Solutions of Resinous Condensation Products.** A. Hill and Imperial Chemical Industries, Ltd.

573,369. **Polymeric Materials.** R. G. R. and L. B. Morgan, J. R. Lewis, and Imperial Chemical Industries, Ltd.

573,430. **Phenol-formaldehyde Resins.** W. Charlton, J. B. Harrison, and Imperial Chemical Industries, Ltd.

573,437. **Synthetic Resins.** Scott Bader & Co., Ltd., and H. C. Bryson.

573,456. **Vinyl Cyanide.** E. I. du Pont de Nemours & Co., Inc.

573,475. **Chlorinated Organic Compounds.** R. T. Foster, N. Bennett, and Imperial Chemical Industries, Ltd.

MACHINERY

United States

2,389,009. **Dipping Form for Hollow Non-Inflatable Rubber Articles of Complex Shape.** N. E. Tillotson, Watertown, Mass.

2,389,178. **Press for Vulcanizing Rubber Disks.** H. Blount, Baltimore, and F. A. Coldehoff, Dundalk, both in Md., assignors to Western Electric Co., Inc., New York, N. Y.

2,389,459. **Apparatus for Applying Adhesive Coating to Cord Fabric.** I. J. Remark and V. V. Wheeler, assignors to General Tire & Rubber Co., all of Akron, O.

2,389,560. **Apparatus for Joining together End Portions of Flat, Thermoplastic Strips.** R. N. Steffens, New York, N. Y.

2,390,171. **Machine for Forming Tubes of Thermoplastic Material.** J. P. Ratay, Washington, D. C.

Dominion of Canada

431,512. **Apparatus for Making Molded Vulcanized Articles of Foam Rubber.** International Latex Processes, Ltd., London, England, assignee of M. M. Cunningham, South Bend, Ind., U.S.A.

431,554. **Automatic Service Turret for Supplying Web Materials Adjacent a Tire Building Machine.** Wingfoot Corp., assignee of J. I. Haase, both of Akron, O., U.S.A.

431,640. **Apparatus for Making Corrugated Tubes.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of W. G. Harding, Fair Lawn, N. J., U.S.A.

431,946. **Apparatus for Forming Films by Extrusion of Molten Polymer.** Canadian Industries, Ltd., Montreal, P. Q., assignee of H. D. Foster and A. W. Larchar, both of Wilmington, Del., U.S.A.

432,044. **Installation for Continuously Vulcanizing by Means of a Hot Liquid under Pressure Elongated Articles as Extruded Bands, Tubes, Etc.** Compagnie Générale d'Electricité, Paris, assignee of R. J. Thibaudeau, Neuilly-sur-Seine, both in France.

United Kingdom

572,933. **Means for Use in Drying and Curing Plastics and the Like.** J. C. Nicholson.

573,021. **Apparatus for Treating Articles under Pressure with High-Frequency Electric Heating.** B. Jablonsky.

573,101. **Tire Vulcanization Presses.** Dunlop Rubber Co., Ltd., and T. Norcross.

UNCLASSIFIED

United States

2,388,698. **Cable Slitter and Insulation Cutter.** R. J. Montgomery, assignor to H. G. Montgomery, both of Chicago, Ill.

2,388,992. **Hose Coupling.** K. Pape, Dover, and A. N. Troshkin, Montclair, assignors to Resistoflex Corp., Belleville, all in N. J.

2,389,255. **Connector for Holding together the Ends of Two Insulated Electrical Conductors.** R. C. Graham, Rome, assignor to General Cable Corp., New York, both in N. Y.

2,389,785. **Hose Clamp.** J. T. King, Burbank, Calif.

2,389,825. **Fire Hose Coupling.** T. R. Smith, assignor to Maytag Co., both of Newton, Iowa.

2,389,895. **Detachable Junction Box for Inflatable Suits.** R. S. Colley, Kent, and C. P. Krupp, Akron, both in O., assignors to B. F. Goodrich Co., New York, N. Y.

2,390,008. **Separable Wheel for Use in Balancing Tire Casings.** F. Sherwood and C. J. Kriz, both of Cheyenne, Wyo.

2,390,070. **Adhesion Preventing Material for the Manufacture of Rubber Goods.** J. M. Auzin, Warwick, R. I., assignor to Davol Rubber Co., a corporation of R. I.

2,390,232. **Hose Clamp.** A. Venditty, Detroit, Mich., assignor to Thompson Products, Inc., Cleveland, O.

2,390,303. **Bead Locking Ring.** F. Herzegh, Shaker Heights, O., assignor to B. F. Goodrich Co., New York, N. Y.

2,390,369. **Machine for Removing the Carcass from a Coated Core.** F. Hopper Patterson, N. J.

Dominion of Canada

431,451. **Skid Chain and Applier.** R. Dabbs, Pittsburgh, Pa., U.S.A.

431,645. **Tire Rim.** Firestone Tire & Rubber Co., assignee of W. S. Brink, both of Akron, O., U.S.A.

431,903. **Tire Shield.** J. A. Jordan, Jr., Norfolk, Va., U.S.A.

United Kingdom

572,904. **Wire Hose Clips.** R. C. S. Jamie and Hunt & Turner, Ltd.

572,932. **Couplings for Flexible Tubes or Electric Cables.** Anglo-Iranian Oil Co., Ltd., and A. C. Hartley.

572,938. **Insulated Electrical Connectors or Terminals.** Stratton & Co., Ltd., and H. N. Cox.

573,140. **Fitting for Use in Converting Solid-Rim Wheels into Wheels Adapted to Receive Demountable Metal or Pneumatic Tires.** N. V. Clarke.

573,305. **Apparatus for Controlling the Operation of Automatic Guns.** Dunlop Rubber Co., Ltd., and H. Trevaskis.

TRADE MARKS

417,263. **Jay Harvey.** Rubber fishing rod butts. Edw. K. Tryon Co., Philadelphia, Pa.

417,264. **Derwyn De Forest.** Rubber fishing rod butts. Edw. K. Tryon Co., Philadelphia, Pa.

417,265. **Scotch.** Pressure-sensitive adhesive tape. Minnesota Mining & Mfg. Co., St. Paul, Minn.

417,267. **Tite-Seal.** Merchandise bags and envelopes made from transparent, semi-transparent and/or opaque heat sealable materials. Traver Corp., Chicago, Ill.

417,271. **Stix-All.** Cement. G. W. Underhill, doing business as G. W. Underhill & Co., Kansas City, Mo.

417,291. **Skil-lo.** Games. Bradley & Mellin, Minneapolis, Minn.

417,298. **Polyplex.** Adhesives. H. J. Heribert, New York, N. Y.

417,341. **World.** Tire tubes. Continental Products, Inc., Chicago, Ill.

417,353. **Ducky.** Nurser nipples. Seamless Rubber Co., New Haven, Conn.

417,396. **Eazy-Mend.** Thermoplastic mending tapes and tabs. Mendex Corp., Cleveland, O.

417,424. **Voltron.** Electric insulation materials. Industrial Synthetics Corp., Irvington, N. J.

417,462. **Duroform.** Plastic compositions. Firestone Tire & Rubber Co., Akron, O.

417,471. **Vaculator.** Rubber bushings and molded plastic handles for vacuum-type coffee brewers. Hill-Shaw Co., Chicago, Ill.

417,473. **Blue Label.** Foundation garments. I. G. Belaief, doing business as Blue Label Foundation Co., New York, N. Y.

417,475. Representation of two children's heads enclosed within a circle next to which is a bar of music with the words: **"Nursery-tyme"** across it. Crib, carriage, bassinette, high chair, and nursery seat pads. Nurserytyme Products, Brooklyn, N. Y.

417,,482. **Roust-A-Bout.** Flexible pipe couplings. Pipe Couplings, Inc., New York, N. Y.

417,527. **Heydenite.** Liquid and solid chemical compounds useful as raw materials and intermediates for synthetic resins. Heyden Chemical Corp., New York, N. Y.

417,543. **Inner Flex.** Hose. General Detroit Corp., Detroit, Mich.

417,555. Representation of a pioneer in a circle around which is the word: **"Pioneer."** Clays. Georgia Kaolin Co., Elizabeth, N. J.

417,482. **Plastex.** Curtains of waterproofed and fireproofed textile fabric for protecting workers on oil derricks, etc. C. T. Lewis, doing business as Lewis Mfg. Co., Oklahoma City, Okla.

417,589. **Wat-R-Seal.** Synthetic resin varnish for application on wood. Grand Rapids Varnish Corp., Grand Rapids, Mich.

417,591. **"Vanderbilt."** Golf and tennis balls. Vanderbilt Tire & Rubber Corp., New York, N. Y.

417,602. **Texcel.** Adhesive tapes. Industrial Tape Corp., New Brunswick, N. J.

417,639. **Homojetized.** Camelback. General Tire & Rubber Co., Akron, O.

417,701. **"Whirl Away."** Rasp bands and wheels for removing rubber tire treads. A. E. Tobey, Santa Cruz, Calif.

417,704. **Luplex.** Adhesive cement. H. J. Heribert, New York, N. Y.

717,706. **Perma-Flex.** Flexible molds for casting plaster, plastics, metals. Perma-Flex Mold Co., Columbus, O.

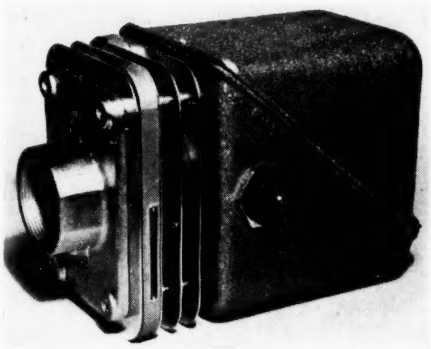
417,719. Representation of an inverted spade with the words: **"Mirakle Suport."** Trusses. V. Scattone, New York, N. Y.

417.722. **ReXon.** Rubber vibration mounts. Hamilton Kent Mfg. Co., Kent, O.

417,723. Representation of an inverted triangle containing the words, **"Sure-Rite,"** and streaks of lightning coming from each corner. Insulating compound for waterproofing ignition systems. Sure-Rite Products Co., Philadelphia, Pa.

417,805. **Nunn. Bush Angle Fashioned.** Footwear. Nunn-Bush Shoe Co., Milwaukee, Wis.

New Machines and Appliances



Fireye Photoelectric Flame-Failure Safeguard Type F18T

New Fireye Flame-Failure Safeguard

THE Combustion Control Corp. has produced the Fireye Flame-Failure Safeguard Type F18T, designed to provide explosion protection for all industrial and commercial oil and pulverized coal burners. Fireye is photoelectric and, unlike thermal controls, is actuated by the flame itself and not by the effect of flame failure. The action is positive, instantaneous, and electronic.

Fireye Type F18T consists of a phototube and amplifying system housed in a dusttight aluminum case. The entire control, mounted directly on the furnace wall, is alined to permit the photoelectric cell to observe the flame through a two-inch pipe connection which serves both as a sighting tube and as a support for the equipment. A clear pyrex filter keeps the equipment dusttight and is mounted on a hinged shutter which permits cleaning without shutting down. A heat-absorbing filter in the lens system, as well as an efficient baffle system, protects Fireye from all radiated heat. The specially designed phototube permits operation at an ambient temperature range of 32 to 150° F.

Other features include a pilot light, which can be viewed



SPILLED MILK-

Why wait until hard lumps appear during calendering. It's too late then. Make it a practice to check the surface temperatures of rolls with the Cambridge Roll Pyrometer. This accurate, quick-acting, rugged instrument instantly indicates the temperatures of still or moving rolls. Write for descriptive bulletins.



Roll Model

CAMBRIDGE INSTRUMENT CO., INC.
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The roll model is for checking surface temperatures of still or moving rolls; the mold type for checking surface temperatures of mold cavities; the needle type for "within-the-mass."

CAMBRIDGE
ROLL • NEEDLE • MOLD
PYROMETERS



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TRADE MARK

AIR CONTROL VALVES



KNOB OPERATED VALVE SHOWN

Valvair valves are new in design and principle, standard valves have been operated more than two million times without leak with air pressure exceeding 100 lbs. They are designed for indefinite life and exceptionally hard service.

They are compact—they do not have metal seals—the body is made of cast bronze and steel parts are made of stainless steel—they will not corrode.

They are made in five sizes—¼, ⅜, ½, ¾ and 1 inch—and in two-way, three-way, and four-way types. They can be furnished in eight or more different designs—knob, lever, foot, cam, clevis, single diaphragm, double diaphragm or solenoid operated.

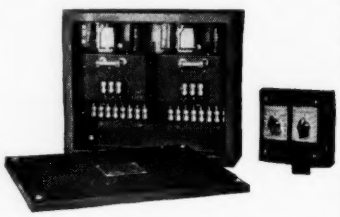
They will control air efficiently up to 200 lbs. pressure with a very light movement. The area through the valves is equivalent to pipe size with minimum pressure drop. Write for literature.

THE SINCLAIR-COLLINS VALVE CO.
454 Morgan Avenue
Akron 11, Ohio

through an angle of 180 degrees, and a time delay element which prevents the relay from dropping out during purely transient flame disturbances. The mechanism operates on 115-230 volts, 50/60 cycles A.C., has a 10-watt power consumption, a single-pole single-throw relay, 5 amperes or ½ h.p. contact at 230 volts A.C., and has a total weight of 12½ pounds.

New Photoswitch Report-Cycle Timer

A RUGGED industrial electronic timer designed for machinery and process control has been produced by Photoswitch, Inc., under the designation of Type 2T15U. The timer is recommended for applications requiring two adjustable timing periods to run in a continuous cycle. The cycle is initiated by either momentary or sustained contacts, and provision for automatic recycling is provided. Each timing period is adjustable from 1/20-second to two minutes. Control is accomplished through specially designed snap-action relays which result in extreme accuracy and interchangeability. Interval variations in repeat cycle timing are less than 2%.

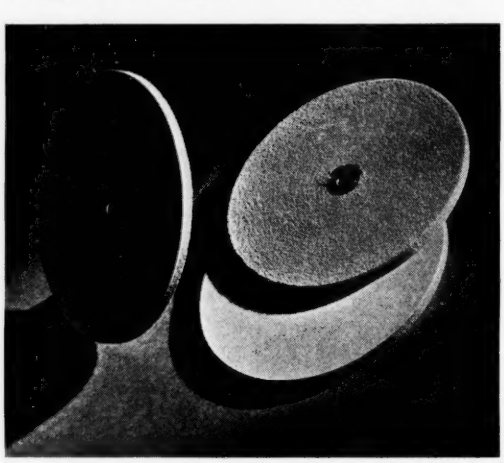


Type 2T15U Industrial Electronic Timer

The timer is universal for six maximum time ranges from 1½ seconds to two minutes for each period of the cycle. Each range is represented by a timing element which is snapped into a clip on the front of the control. The timer may then be set for any intervals up to these maximum periods by dials which are located either on the timer itself or in a small housing at a more convenient location. The timer operates on 115 volts A.C. or D.C. and has for output connections those of a single-pole, double-throw switch for normally open and closed operations. Its contacts are 1000 watts, 115 to 600 volts A.C., and 500 watts, 115 to 220 volts D.C.

New Refacing Stone for Abrasive Wheels

THE Taber Instrument Corp., North Tonawanda, N. Y., is making a new duplex refacing stone for refacing the calibrase wheels on its Taber abraser, a function previously performed by means of abrasive-coated paper disks. One side of the stone is a coarse grit for refacing the wheels at the start of test, and the other side is a fine grit for use at intervals during a test. The advantage claimed by use of the stone is improved control of the wheel surfaces by eliminating or minimizing the possibility of picking up additional grit, thus assuring standardization of the wheels. The duplex refacing stone is also more economical than abrasive-coated paper disks owing to a much longer wear-life.



Calibrase Wheels of Taber Abraser after Refacing

EUROPE

GREAT BRITAIN

Rubber Prices

A question repeatedly coming up in the House of Commons is why the government, having undertaken to pay ls.6d. a pound for Ceylon rubber until September, 1946, pays only 10d. a pound for Malayan rubber. On one occasion it was explained that the Ceylon price was fixed before the end of the Japanese war when Ceylon was the main source of supply for the United Nations. It was designed to secure maximum production despite costs in certain areas and the competing demands for labor for other essential purposes.

However this answer has not seemed entirely satisfactory either to those interested in the welfare of the plantation industry or in that of Far Eastern labor, for it is evidently felt that the price is too low to permit adequate payments to white planters and native labor. In the course of questions and answers on the subject during a session held in the House of Commons on December 5, it developed that the wages of such labor as had been reemployed (in Malaya) had been raised by 33%. In view of existing conditions no indication could as yet be given of what might be regarded as reasonable scales of payment, but it was revealed that an investigation was being carried out by the Military Administration to ascertain the current cost of living for workers. As to the price for Malayan rubber, the government was said to be consulting on the matter with rubber producers.

Incidently, about a week after the closing of the sittings of the Rubber Study Group in London, it was suggested in the House of Commons that a representative from among the packers and shippers of native rubber should be appointed to the Group to insure better protection of native rubber-producing interests.

Sir Stafford Cripps replied that the interests of the native rubber producers could be safely left in the hands of the official members of the United Kingdom delegation, a reply that drew forth the query:

"Is the right honorable and learned Gentleman aware that it is not the general opinion that the interests of the natives are being safeguarded at present?"

I.R.I. Meetings and Programs

At a meeting of the general council of the Institution of the Rubber Industry on November 27, 1945, it was unanimously decided to award the Colwyn Medal for 1945 to W. J. S. Naunton for conspicuous services to the rubber industry.

The date for the annual general meeting of the Institution was set for March 8, 1946.

As president for 1946 was nominated H. W. Franklin.

The program of the I.R.I. lectures for December included:

London Section. December 10. "A Survey of German Synthetic Rubber Technology," by G. L. Hammond.

Midland Section. December 10 (Birmingham). "Postwar Rubber Prospects in the United States," L. H. Bennett.

West of England Section. December 12. "Natural Rubber Production in the Postwar Era," G. Martin.

Scottish Section. December 11 (Glasgow). "Costing and Wage Payment," W. H. Lundie.

Manchester Section. December 17. "Synthetic Polymers in the War Effort," S. J. Skinner.

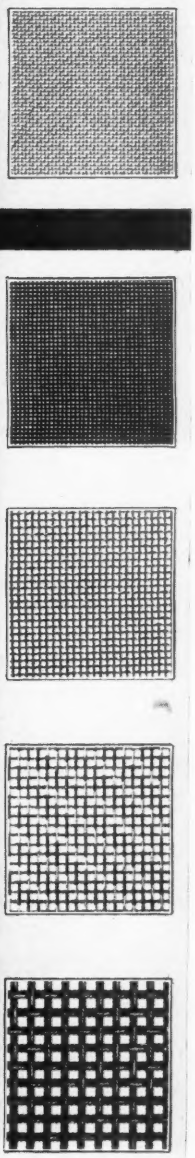
Leicester Section. December 19. "X-Ray Structural Analysis of Higher Polymers," G. A. Jeffrey.

Company Notes

Itshide, Ltd., Petersfield, Hants., has changed its name to Itshide Rubber Co., Ltd.

Peak Footwear Co., Ltd., London, formerly Zenith Footwear Co., has again changed its name. It is now known as Peak Rubber & Plastics, Ltd.

LUDLOW-SAYLOR



Ludlow-Saylor precision wire cloths, wire screens, and woven wire products, are built for durability. Available in fine mesh for straining or filtering, or in heavy diameter wire of coarse mesh, they will be fabricated exactly as your blueprints specify, in continuous lengths, or cut to size and processed to fit your equipment.

Your inquiries are invited for wire cloths, in a variety of weaves, of all commercial metals or alloys.

Our 90TH Anniversary 1856-1946

The LUDLOW-SAYLOR WIRE COMPANY
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MAINTENANCE DATA SHEET NO. 1

CALIBRATION OF SCOTT TESTERS

The recording head of an inclinable balance Scott Tester is in reality a weighing scale. However, it works in one direction only, so that it cannot balance back and settle into position if the weight is dropped or otherwise applied too abruptly.

To calibrate, have available a weight of known amount. Balance the machine by allowing the pendulum lever to swing to its normal position, dead center, and adjust the pointer to zero on the dial. Attach the known weight to the upper clamp, which is connected to the chain of the recording head. (In computing the amount of the known weight, include the weight of all apparatus used to attach it.)

Allow the weight to exert its force by lowering gradually by hand. Do not drop it, but do not lower too slowly. Use the speed at which stress is applied in an actual test. The pointer should register upon the dial the exact amount of the known weight plus the attaching apparatus.

The pawls must be in the same position on the quadrant racks as in actual testing. The weight must be attached without binding or friction that would prevent the full force registering on the dial. The weight may be a pail of water, a bolt of cloth, a roll of paper, sash weights, etc. Whatever the weight, it MUST be accurately weighed.

Every Scott Tester is fully tested and calibrated at the factory, therefore, it is safe to assume that accuracy at any one point of the dial indicates a correct machine at all points.

The many Scott Testers supply the needs of testing textiles, rubber, wire, paper, etc., up to 1 ton tensile.



REQUEST "CATALOG & DATA BOOK NO. 45"

SCOTT TESTERS, INC.

90 Blackstone St., Providence, R. I.

Toward the end of 1945, 28 more government factories were allocated for civilian production, two being released to rubber interests. The Dunlop Rubber Co., Ltd., took over one factory at Castle Bromwich, which is to be used for research. At another factory at Manchester, rubber linings for acid tanks will be made.

L. G. G. Charlesworth, Ltd., recently took over a plant at Sutton Coldfield, where plastic molding will be manufactured.

Turner & Newall, Ltd., manufacturer of asbestos, magnesia, and allied products, are providing funds for eight research fellowships in engineering, inorganic chemistry, physics, or allied sciences, for a period of seven years. The Fellowships, which will be for £600 a year, are to be known as "Turner & Newall Research Fellowships," and the Manchester University is to have four, the University of London two, and the Leeds University and the University of Durham, one each.

In the beginning of July the "Britain Can Make It" exhibition is to be held. Lord Woolton, chairman of the board of selectors, appealed to manufacturers in the rubber industry early last December to start their plans for preparing their entries immediately. The Exhibition is to be a symbol of the changeover in production from war to peace. The Board of Trade will sponsor the release from the Armed Forces of skilled industrial designers who may be needed to help their firms prepare exhibits.

The Trade Association, Chambers of Commerce, or Regional Offices of the Board of Trade and Ministers of Aircraft Production and Supply are all prepared to give guidance on procedure to those who seek it.

FRANCE

On the recommendation of Brigadier-General Frank A. Allen, Chief of the U.S.A. Supply Services in France, the S.A. des Pneumatiques Dunlop has been awarded the "Pennon of Merit," highest award for services rendered during the war. Despite serious damage caused by bombing and the difficulty of making necessary repairs, the company's factory was quickly restarted and supplied tires of remarkable quality. According to the manager of Dunlop's French branch, France's requirements in 1946 include 1,000,000 truck tires and 670,000 touring car tires as well as 125,000 truck tires and 140,000 light car tires for military purposes.

Bad luck has reportedly attended the first consignment of used tires sent recently from England to Le Havre, whence it was to be taken to Paris in trucks. A total of 46,000 used tires had been ordered, of which half was still usable, while the rest needed retreading. But it seems that when the shipment reached Paris, all but 5% of the tires in usable condition were missing. Neither the customs officials nor the truck drivers had any notion of how the theft could have occurred.

Meanwhile we learn that the black market in tires is flourishing wildly. A single passengar-car tire now fetches 15,000 francs on the black market, while one truck tire sells for 100,000 francs.

The Institut Francais du Caoutchouc gave a series of eight lectures on rubber at meetings held in the period March-May, 1945. Each meeting was presided over by a leading personality in industrial and scientific circles. The papers read were: "Particle Size of Pigments in the Rubber Industry," by M. H. Rabate; "Evolution of Traction and Compression Tests," M. A. Haehl; "General Observations on Interface Phenomena," M. G. Austerweil; "Problems in Hose Manufacture," M. R. Walter; "Infrared Rays in the Rubber Industry," M. M. Deribere, engineer at the Compagnie des Lampes; "Rubber-Bearing Plants of the Temperate Regions," M. P. Compagnon, assistant director of the Institut Francais du Caoutchouc; "Standardization of Materials and Compounds," M. R. Hublin, head of the laboratory of the Société Colombes-Goodrich; "Some Aspects of Polymerization," M. M. Fournier, head of the central laboratory of the Société Alais, Froges et Camarque.

BELGIUM

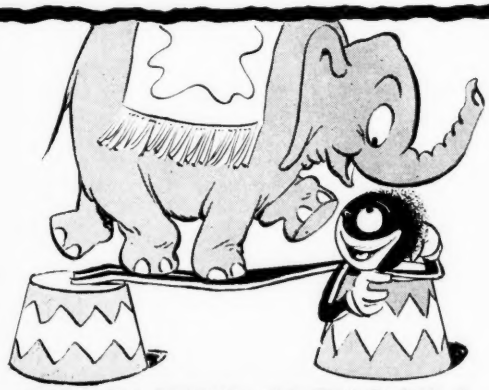
As reports by American and British official investigators are released, news of the activities of European rubber companies under German occupation conditions is gradually becoming available.

A recent report of this kind gives some interesting information regarding production and raw materials used at the factory of Englebert Fils S. A., at Liege, Belgium. Before the war this company, which also has a factory at Aachen, Germany, was the leading producer of tires in Belgium. In addition the concern made belting, hose, and molded goods for civilian as well as military needs. The monthly consumption of crude rubber by the Liege factory in prewar times is said to have been 600 tons, but during the period of the occupation, the average seems to have been only 60 tons a month, for the most part Buna.

The records indicate that at the time of the German invasion in 1940 the company had on hand about 600 tons of natural rubber, which the Germans did not remove. This rubber lasted until 1941, but it was not until June, 1941, that the first shipment of Buna S—about 30 tons—was received from the Schkopau factory. Besides synthetic rubber the company also received small amounts of natural rubber and continued to do so as late as March, 1944. In the manufacture of tires, the natural rubber was used for breaker and cushion, but toward the end of the war the breaker seems to have been omitted altogether, and natural rubber was used for the cushion only.

Partly owing to the difficulties attending the processing of Buna, but mainly, it would appear, owing to deliberate slowdowns in production, outputs of automobile tires during the occupation remained considerably below the prewar figures. Thus average monthly production of passenger-car and truck tires in 1943/44 came to only 30,000 units, against a prewar average of 75,000 units a month. At the same time, however, the factory produced 12,300 motorcycle tires and 250,000 bicycle tires a month under the Germans. Comparable prewar figures for these goods do not seem to have been available. The company also put out a certain amount of airplane tires experimentally.

The Liege plant received various types of Buna: Buna S, for general use; Buna SS, for molding; Buna SR, for tubing. This last type of Buna was specially developed by the Germans after their first cold Russian winter. It is said to be very good for the manufacture of tubes and to withstand cold well. What may be termed minute amounts of Buna SSE and Buna N were obtained from Germany. The former type of Buna was intended to replace natural rubber for solutions, but is not successful as it cyclizes too rapidly; the latter is, of course, the well-known oil-resistant Perbunan. Then there were Buna 32, a fluid product used as a plasticizer, and Buna SIII, designed to take the place of natural rubber in tires, but it is too sticky and is used for carcasses, but not for treads. Instead of cotton, rayon naturally had to be used for cord,

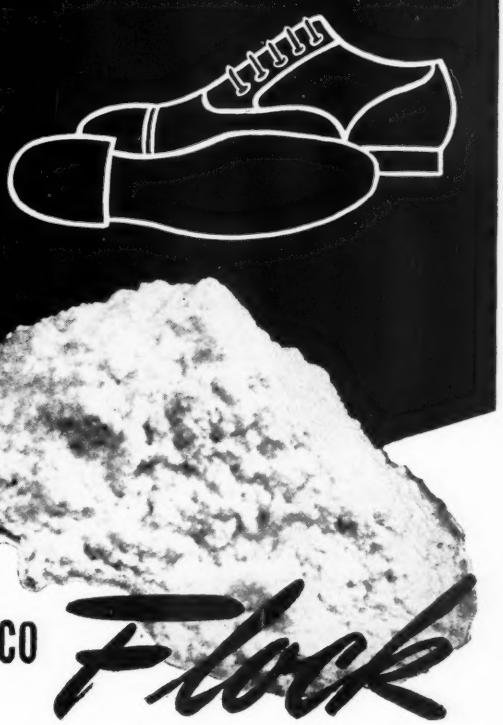


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and it was impregnated with Buna latex. The problem of carbon black supplies was solved by two types of blacks, CK3 and CK4, sent from Germany. These blacks are said to be specially useful for Buna. In addition aluminum oxide, called by the Germans "White Carbon," was used as a substitute for carbon black. The Germans are said to have found this material very satisfactory and intend to continue its use as it is considered a good reenforcing pigment.

Various softeners, tackifiers, and special accelerator for Buna were also supplied by the Germans.

The Germans experienced the same trouble with Buna tires that the Russians reported when they began using synthetic rubber tires before the war—the plies separate long before the tread is worn down. Consequently the Germans have reduced the thickness of the treads by as much as three millimeters. It is thought that the separation of plies is due to air entrapped during vulcanization when the Buna is cured and forms an impervious skin before the air has had a chance to diffuse out. This difficulty seems to be to some extent avoided by substituting pit heater for single mold vulcanization. The best Buna tires are said to be obtained when 70% depolymerized Buna and 30% untreated Buna are used.

SWEDEN

Sweden is becoming increasingly active in the production of plastics and articles made from them, a trend that is amply reflected in official statistics of the country's imports of these goods. Whereas imports of plastics in the first half of 1944 amounted to 890 tons, they came to only 100 tons in the corresponding period of 1945.

Exhibits shown at a recently held industrial fair indicated that two principal types of plastics are produced here, one known as Nopoline and the other as Mepal. The latter name covers melamine resins with fillers added. The melamine resins are also marketed in the form of water-soluble powders for adhesive purposes, particularly in the manufacture of plywood and furniture.

Nopoline is a polyvinyl material which apparently appeared on the market only a few months ago although it was experimentally developed about two years earlier. At the fair Nopoline products were shown in three colors, and the goods included raincoats, umbrellas, shower curtains, handbags, articles for infants' wear, aprons, table covers, and bathing caps.

Axel Kjores, Sweden's Minister of Civilian Supply, announced recently that his government had obtained 27,500 used tires from a lot of 200,000 put up for sale from American Army supply depots in France. Sweden is also to get 5,000 new and a further 3,000 used tires from the United States.

Because of the grave shortage of tires, transportation especially of wood (instead of coal) for industrial purposes and for heating homes was becoming a serious problem. The tires now purchased will help materially to maintain essential transport.

ITALY

The solution of Italy's acute tire situation is now said to depend primarily on coal and rubber since Italian tire factories, which have an annual production capacity of more than 1,000,000 tires for motor vehicles, have already completely repaired all damages sustained in the war and are otherwise in a position to resume operations immediately.

The synthetic rubber factory at Ferrara is also almost completely restored and, if the necessary raw materials were available in adequate amounts, would be able to supply all rubber needs except a certain amount—put at 1,700 tons—of natural rubber. It is estimated that in 1946, Italy will require 568,200 tires and 528,200 tubes for passenger cars in addition to 476,500 tires and 451,500 tubes for trucks and trailers.

GERMANY

Conversion from war to peacetime production is making a certain amount of headway in Germany, European press reports indicate. A chemical plant at Harburg, it is stated, is making synthetic rubber belting for Ruhr coal mines.

FAR EAST

MALAYA

In Malaya a difference of opinion exists as to what should be the price of rubber. While the Chinese rubber producers are said to be complaining that the price of 36 cents (straits currency) per pound is too low, the *Straits Times* is quoted as saying:

"The Malayan rubber industry has emerged from the World War only to enter upon a new war of its own—a war with its synthetic competitor—and there is only one safe and sane slogan for this country today: 'Cheap rubber and plenty of it.'"

INDO-CHINA

While tons of crude rubber are available for shipment from Indo-China to the United States, it cannot be loaded on the American flagged ship waiting to carry it because of the disorganized state of loading facilities aggravated by the hostile attitude of Annamites toward stevedores, which makes it impossible to obtain local labor for loading. A representative of the shipping company concerned has had to ask Washington to send no more ships solely to carry Indo-China rubber until conditions improve.

AUSTRALIA

In the latter part of 1945, Australia was reportedly preparing to produce acetylene black. Electronic Industries, Ltd., South Melbourne, Victoria, had arranged with Shawinigan Chemicals, Ltd., of Canada, to manufacture acetylene black according to the process used by that company, and production was scheduled to begin before the end of the year, with output sufficient to meet Australia's needs.

Australia's rubber industry has expanded markedly in recent years. Production of rubber goods rose steadily during the decade ending with 1943, from £5,173,095 in 1933-34, to £7,108,024 in 1938-39, and to £10,678,213, in 1942-43. Figures for the years 1938-39, to 1941-42 show a similar advance in the country's exports of rubber goods: £91,003 in 1938-39; £113,765 in 1939-40; £433,301 in 1940-41; and £420,963 in 1941-42. At the same time imports of rubber and rubber manufactures increased from £1,545,366 in 1938-39 to £2,641,164 in 1941-42; crude rubber accounted for £1,125,251 and £2,062,174, in the respective years. Of the rubber goods imports, the most important item, according to total value, was elastic for apparel, £152,580 in 1938-39 and £209,861 in 1941-42. While about one-third of the total in the former period was supplied by the United Kingdom, the proportion rose to almost 90% in the latter period. Imports of pneumatic tires and tubes increased from £28,094 to £144,981. But imports of many other rubber manufactures fell, including floor coverings, from £16,235 to £1,225; rubber gloves, from £3,456 to £1,451; rubber medical sundries, from £17,753 to £5,604; and other articles not specified, from £83,293 to £55,067.



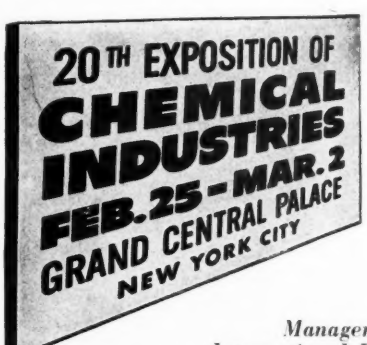
Vital NEW information, much of it developed during the war, awaits you at the 20th Exposition of Chemical Industries at Grand Central Palace, New York, from February 25 to March 2—*practical* information . . . and *more of it* than has ever been marshalled together *anywhere.*

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AFRICA

As the more accessible areas of the wild-growing rubber-producing vines in Belgian Congo become exhausted, laborers have to penetrate deeper and deeper into the jungle to collect adequate amounts of rubber. Consequently this work is not popular. But while the war lasted, the natives produced increasing quantities of rubber. Since the end of hostilities, however, a slackening of effort is reported, despite the fact that the Rubber Commission is at pains to stress the need of continued maximum production. A similar attitude is noted on the rubber estates where superintendents have requested permission to discontinue the heavy tapping systems that have been enforced. To what extent this tendency to relax is reflected in output is not yet known.

In the first quarter of 1945, exports of plantation rubber from Belgian Congo were 390,231 kilograms, and of native rubber, 1,966,278 kilograms. Of this the United States received 1,496,218 kilograms, Union of South Africa, 373,011 kilograms, and Belgium, 486,280 kilograms.

Tanganyika Territory, East Africa, exported 3,700 tons of rubber since it started producing rubber three years ago.

New Synthetic Rubbers

(Continued from page 669)

have been described undoubtedly do not represent the final stage in the development of synthetic rubbers based on methylpentadiene, but it is believed that the work that has been done so far has demonstrated that methylpentadiene should be given serious consideration as a raw material for making a new and valuable class of synthetic rubbers.

Test Procedures Used

1. Mooney plasticity. Determined with the standard large rotor ($1\frac{1}{2}$-inch diameter), allowing a warm-up time of one minute and reading after $1\frac{1}{2}$ minutes' running.
2. Tensile, elongation, and modulus. A.S.T.M. method D412-41. Average of four dumbbells (die C) reported.
3. Permanent set. Set at break, determined by measuring broken dumbbells.
4. Tear strength. A.S.T.M. method D624-41T (die B). Average of four tests reported.
5. Hardness. Shore A durometer.
6. Rebound. Rebound in per cent of fall, determined with a falling ball tester at room temperature (approximately 25° C.) and at 100° C.
7. Cut growth. (Hot.) Number of flexes required to cause a 1-cm. increase in length of nick in a grooved de-Mattia type flex piece. Samples are maintained at 100° C. and are flexed at a rate of 120 cycles per minute, through an angle of -10° to +97° from the rest position. Average of two tests reported.
8. Stiffening temperature. Temperature at which vulcanized sample immersed in an alcohol-dry ice bath becomes stiff, as judged by manual test.
9. Aging. A.S.T.M. method D573-42. An air temperature of 80° C. ± 2° C. is maintained in a single-pass oven equipped with distributing baffles which passes preheated air over the samples at a rate of 20 linear feet per minute.

Acknowledgments

Thanks are due to J. N. Wilson for the molecular weight measurements, C. Klute for testing the vulcanized polymers, H. Luck for the development of photographic techniques useful in the investigation, Pacific Tire & Rubber Co., of Oakland, Calif., for building the test tires, Shell Oil Co., Inc., for cooperation in the road tests, and to the following who participated in the laboratory work: R. Sullivan, S. Page, and J. Perona.

Editor's Book Table

BOOK REVIEWS

"Principles of Industrial Process Control." Donald P. Eckman. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Cloth, 5½ by 8½ inches, 246 pages. Price $3.50.

This book is the first of its kind to be published concerning the overall basic fundamentals of the science of automatic industrial control. The author, an instrument company engineer, has written a comprehensive and practical treatment of this subject which includes material hitherto scattered throughout the literature. The material is presented in language understandable to the average engineer, without the need of advanced mathematics, and should be valuable as an industrial training manual or college textbook.

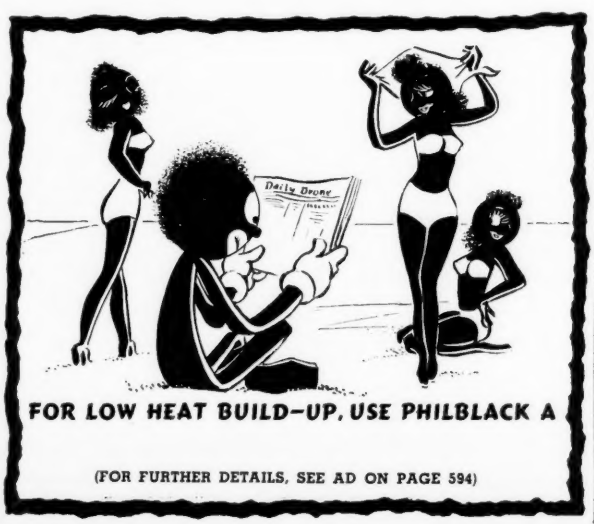
Subjects covered include: measuring means of industrial controllers, characteristics of measuring means, modes of automatic control, final control elements, process characteristics, theory of automatic control, quality of automatic control, application control engineering, automatic control systems, and the maintenance of exact control. In addition to an index there is a list of 119 references and a glossary of 126 terms and definitions.

"A.S.T.M. Standards of Electrical Insulating Materials (with Related Information)." American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa. October, 1945. Paper, 9 by 6 inches, 558 pages. Price $3.25 to nonmembers.

This compilation, by Committee D-9 on Electrical Insulating Materials, gives in their latest form the more than 75 widely used specifications and test methods covering electrical insulating materials and related products. Also included are emergency standards and emergency alternate provisions for certain critical materials. The specifications and test methods are given in groups covering coatings, molded and fabricated plastics, mineral oils, ceramic products, solid filling and treating compounds, insulating paper, mica products, rubber products, textile materials, and conditioning, enclosures, and servicing units. In addition are several reports covering the significance of tests of insulating materials, a proposed method of testing askarels, and most recent recommendations affecting standards on electrical insulating materials. A detailed subject index is appended, together with a list of committee and sub-committee members.

"Organic Preparations." Conrad Weygand. Interscience Publishers, Inc., 215 Fourth Ave., New York 3, N. Y. Cloth, 6 by 9 inches, 546 pages. Price $6.

This volume is a translation of Part II, *"Reaktionen,"* of the author's *"Organisch-chemische Experimentierkunst,"*



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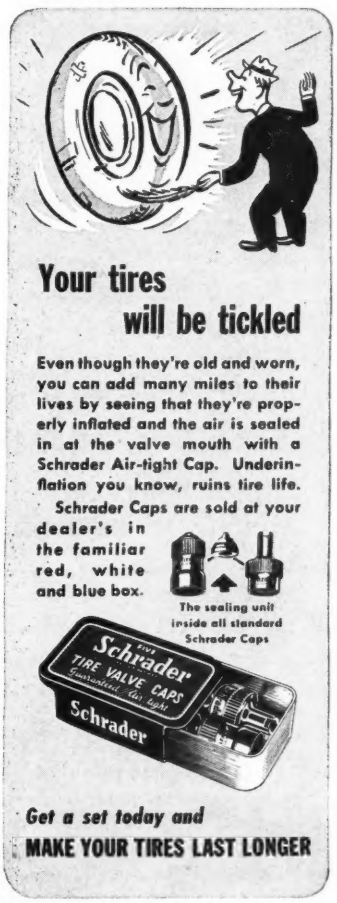
(FOR FURTHER DETAILS, SEE AD ON PAGE 594)

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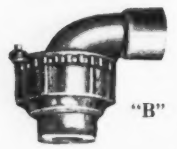
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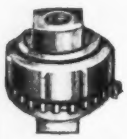
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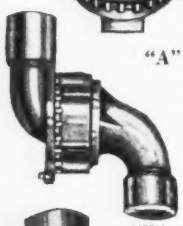
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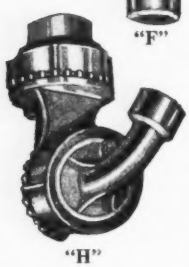
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published in 1938 in Leipzig. Although the book is primarily useful as a reference text in the preparation of organic compounds, the inclusion of many laboratory methods as examples in the text makes the volume valuable for research laboratories. This translation should fulfill a definite need in the literature for a reference work in which the reactions of organic synthesis are sufficiently detailed to permit their use in new work.

Chapters discuss the formation of carbon-hydrogen bonds by addition and by exchange; the formation of carbon-halogen bonds by addition and by substitution; the formation of carbon-oxygen bonds by addition, by exchange, with the formation of hydroxyl and carbonyl groups, and by replacement of halogen; the cleavage of carbon-oxygen bonds; the formation of organic derivatives of trivalent nitrogen, including amines, hydrazines, azo compounds, imines, nitriles, etc.; the cleavage of carbon-nitrogen bonds; the formation of carbon-pentavalent nitrogen linkages; carbon-divalent sulphur bonds; carbon-hexavalent sulphur bonds; unsaturated carbon bonds; the formation of carbon-carbon bonds by addition and by replacement; the fission of carbon-carbon bonds; and the rearrangements of carbon compounds, with the exception of steric rearrangements.

In addition to actual laboratory examples, there are many references made to the literature throughout the text. A comprehensive subject index is appended.

"Chemical Engineering Catalog—1945-46." Thirtieth Annual Edition. Reinhold Publishing Corp., 330 W. 42nd St., New York 18, N. Y. Cloth, 11 by 8 inches, 1708 pages. Price $3.

The current edition of this standard reference volume gives data on equipment, supplies, chemicals and materials in the chemical industry, as provided by more than 600 companies. An index of trade names is also included. The section on technical and scientific books has again been curtailed owing to paper restrictions and lists only those books in print by the publisher and by the publishers cooperating in this section of the Catalog.

NEW PUBLICATIONS

"Koresin Tackifier for GR-S Rubber." General Aniline & Film Corp., 247 Park Ave., New York 17, N. Y. Preliminary Data Bulletin No. 201. October 1, 1945. 8 pages. Koresin, a highly regarded tackifier for GR-S, is described in this bulletin. The physical properties, solubility characteristics, and use possibilities of this material are given, together with a description of the company's tack test and diagrams of results obtained in tests of this tackifier in GR-S compounds. There is also an abstract of the section on Koresin of the WPB-RFC "Summary Report on the Production and Performance of German Synthetic Tires and Other Transportation Items" wherein the use of this material in Germany is reviewed, and formulations are given for a freshening solution and for a GR-S cement containing Koresin.

"I Did Leave Home." Walter J. Murphy. Christmas, 1945. 56 pages. This is the author's personal diary covering a two months' trip to Europe in May and June of 1945 and written originally with no thought of publishing it. The author, editor of *Industrial and Engineering Chemistry*, traveled on a chemical intelligence mission. The booklet, however, is non-technical and concerned with the trip itself, with descriptions of the effect of the war on people and cities, particularly in England and Germany. There are snapshot illustrations of fellow chemical travelers and scenes of devastation in Europe.

Publications of The British Rubber Producers' Research Association, 48 Tewin Rd., Welwyn Garden City, Herts, England. **"Accuracy of Atomic Coordinates Derived from Fourier Synthesis."** A. D. Booth. 2 pages. **"Structure of Dibenzyl."** G. A. Jeffery. 2 pages. **"A Method for Calculating Reciprocal Spacings for X-Ray Reflections from a Monoclinic Crystal."** A. D. Booth. 1 page. Publication No. 62. 8 pages. **"Two New Modifications of the Fourier Method of X-Ray Structure Analysis."** A. D. Booth.

Publications of Taylor Instrument Cos., Rochester, N. Y. **"Taylor Level-Buoy.** Buoyancy-Type Liquid Level Instruments." Bulletin 98161. 8 pages. August, 1945. **"Taylor 'Fulscope' Process Time Controllers** for Temperature and Pressure." Bulletin 98152. 4 pages. August, 1944 edition. Bulletin 98161 gives a description of the purpose, construction, and operation of the Level-Buoy indicating controller, together with illustrations and diagrams of installations. Bulletin 98152 describes the process timing mechanism, a device built into the 94R-type Fulscope temperature or pressure recording Controller for the purpose of timing batch processes such as rubber vulcanizers, hosiery dye machines, etc., and now generally available again. Illustrations and piping diagrams are included.

"Geon Latex Emulsion Compounding." Technical Bulletin PM3A. B. F. Goodrich Chemical Co., Rose Bldg., Cleveland 15, O. 6 pages. In this, the second of a series of bulletins on Geon latex, topics discussed are types and physical character of emulsions, dispersing agents, the effect of various dispersants in plasticizer emulsions, preparation of emulsions, and evaluation of emulsions. The section on evaluation covers surface tension, viscosity, and visual tests. Photographic and diagrammatic illustrations are given.

"How to Get Extra Service Out of Truck Tires." The Rubber Manufacturers Association, Inc., 444 Madison Ave., New York, N. Y. 28 pages. A revision and compilation appear in one manual of all previously published material by the Association on the care and maintenance of heavy-duty truck tires. Extensively illustrated with diagrams and photographs, the booklet contains sections on overloading, overinflation, underinflation, abnormal tread wear, excessive heat, tubes, matching of duals, and careful driving. A table of truck tire loads and inflations is included. Similar manuals for passenger-car, agricultural equipment, and aviation tires are also in process of preparation.

"The Second Anniversary of the Goodyear Research Laboratory." David Dietz. The Goodyear Tire & Rubber Co., Akron, O. 28 pages. This illustrated booklet reviews the accomplishments of the laboratory during its first two years of operation. These developments include the bullet-sealing tank, new synthetic rubbers, two new GR-S accelerators, chlorinated synthetic rubber, Pliobond, vinyl chloride copolymers, Pliofoam, and Dektred. There is also a section on peacetime uses for these products: The insulation properties of Pliofoam make it suitable for use in refrigerators, freezers, and air conditioners, in addition to its qualities as a sound insulator for aviation and other uses. The application of vinyl chloride polymers to packaging, waterproof clothing, and wall and furniture coverings is pointed out, besides outdoor uses ranging from garden hose to weatherproofing and wire insulation. Dektred can be used for non-skid surfaces on cargo vessels and around machinery on the farm and in shops. Pliobond will serve as a general household adhesive and in many industries including the building industry, owing to its ability to bond plywood and dissimilar materials.

"Foreign Commerce and Navigation of the United States for the Calendar Year 1942." Bureau of the Census, United States Department of Commerce, Washington, D. C. Indexed. 1014 pages. For sale by the Superintendent of Documents, Washington, D. C. Publication of the 1942 annual report of foreign commerce of the U. S. was delayed by war restrictions, except for some partial statistics released in July, 1944. As in preceding reports, imports and exports are covered by articles, countries, and customs districts. Figures are included for scrap rubber, synthetic rubber, rubber and rubber substitutes, cements, compounding agents, and products.

"Plastics. The Story of an Industry." The Society of the Plastics Industry, Inc., 295 Madison Ave., New York, N. Y. 36 pages. This non-technical, but comprehensive survey of the plastics industry is issued to supply the public and, in particular, returning service men with authentic data on plastics. Adequately illustrated with diagrams and photographs, the booklet reviews the history and development of the plastics industry, its organizational make-up, the classes, properties, uses, and forming operations of the various plastics, future expectations, employment opportunities, and educational facilities. A list of trade publications and bibliography are given.

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"Monsanto Magazine: Nucleonics Issue." Vol. XXIV, No. 6. Monsanto Chemical Co., St. Louis, Mo. 36 pages. This is a special issue devoted entirely to the story of nucleonics, with articles by scientists and men who contributed to the development of the atomic bomb. George Gamow writes on "Can Man Compete with the Sun?" Maj. Gen. Leslie R. Groves reviews "An American Achievement," and Col. Kenneth D. Nichols' topic is "Cooperation —Plus." An article by M. D. Whitaker covers "Dogpatch," the code name for the Manhattan project. John C. Warner contributes "Principles of Atomic Power," and Charles A. Thomas writes on "Epoch in the Desert," the story of the first atomic bomb explosion in New Mexico. In the concluding article Arthur H. Compton speculates on the future of atomic energy in "Some Implications of Atomic Power." In addition to the articles are other informative features and many illustrations.

"Dow Corning Mold Release, Fluid and Compound." Dow Corning Corp., Midland, Mich. 8 pages. This booklet describes two silicone products, DC mold release fluid and DC 7 compound. The fluid is recommended to secure the release of rubber or plastic materials fabricated by injection or compression molding. The compound is intended for use in low-pressure laminating and for casting thermoplastic and polymerizing types of plastics. Properties of the two products are given, together with a description of their uses and methods of application.

"Motorized America in War and Peace." Automotive Safety Foundation, Washington, D. C. 60 pages. This publication is a document, by means of photographs and explanatory notes, of the work performed at home and abroad by highway transportation during the war. Illustrations reveal the use of motorized equipment in almost every application by the Armed Forces, and the transportation problems here in this country. Concluding the book is a section highlighting the aftermath of the war, including the increase in traffic deaths and accidents, the worn-out highways, and the over-age cars, and stressing the need of education, enforcement, and engineering to bring down the traffic toll.

"Type G. Pumps." Bulletin No. 51. The LaBour Co., Inc., Elkhart, Ind. 12 pages. Described is a packingless, self-priming, centrifugal pump suitable for use in drainage service, mine dewatering, irrigation, tank car unloading, tower service, and other similar applications. The booklet also contains design data and instructions on installation and operation of the pump.

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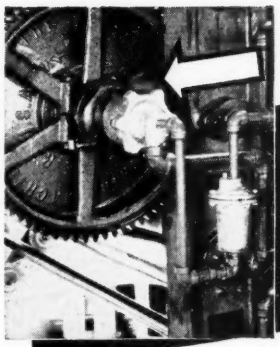
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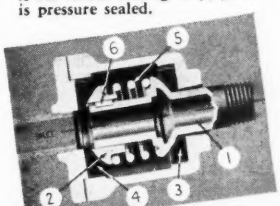
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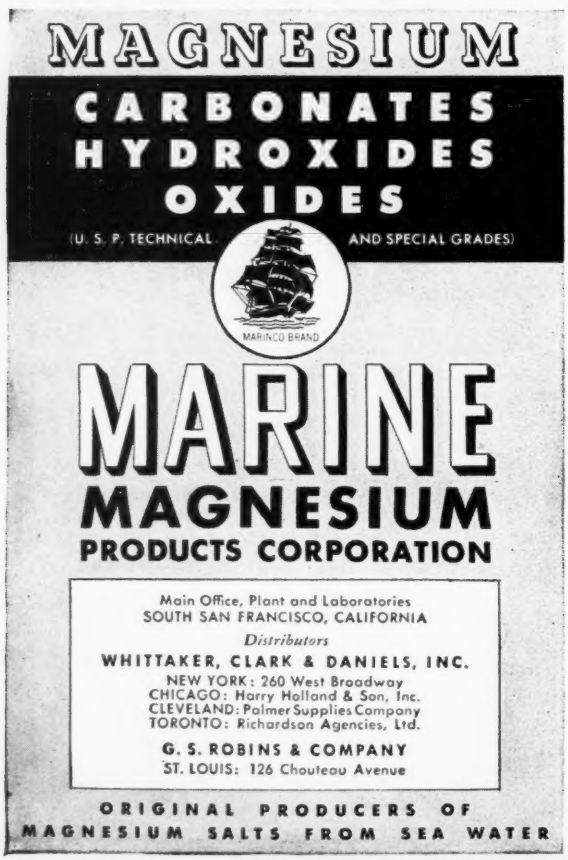
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Impact of Air Attack

(Continued from page 652)

of Buna to date came from the Schkopau plant, and approximately 30% from Hüls. The loss of these two plants would have grave effect on German rubber production, despite the fact that when the new plant reaches full capacity, the total production will be back to two thirds of the original output."

—From German Air Force Staff, Plans Division Report of August 3, 1944.

"Since the supplies of rubber are becoming scarce (production at several German tire factories has been interrupted, and the French tire industry as a whole has been lost), the plants producing Buna gain increased importance as targets."

—From German Air Force Staff, Plans Division Report of December 10, 1944.

Dominion of Canada Statistics

Imports of Crude and Manufactured Rubber

	November, 1945		November, 1944	
	Quantity	Value	Quantity	Value
UNMANUFACTURED				
Crude rubber, etc.....lbs.	566,350	$ 82,286	587,451	$ 100,814
Latex (dry weight)....lbs.	3,982	1,895	5,113	1,636
Balata .....lbs.	.....	.....	250	624
Rubber, powdered and waste .....lbs.	605,100	17,505	77,500	2,906
Recovered .....lbs.	1,729,600	127,759	1,216,300	90,367
Substitute .....lbs.	327,800	90,660	424,900	122,754
TOTALS	3,232,832	$ 320,105	2,311,514	$ 319,101
PARTLY MANUFACTURED				
Hard rubber in rods or tubes .....lbs.	96	$ 170	1,625	$ 1,238
Rubber thread not covered .....lbs.	2,469	2,740	5,111	5,987
TOTALS	2,565	$ 2,910	6,736	$ 7,225
MANUFACTURED				
Belting	.....	$ 39,747	.....	$ 29,667
Boots and shoes of rubber, n.o.p. .....prs.	12,554	9,111	117	126
Cement	.....	19,593	.....	11,937
Clothing of waterproofed cotton or rubber	.....	680	.....	1,147
Druggists' sundries	.....	22,495	.....	25,048
Gaskets and washers	.....	12,223	.....	7,851
Gloves, rubber ...doz. prs.	2,179	5,943	760	2,429
Golf balls .....doz.	2	24	1	10
Heels .....prs.	200	20	.....	.....
Hose	.....	29,842	.....	22,416
Hot water bottles	.....	205	.....	1,731
Inner tubes .....no.	103	218	153	927
Bicycles .....no.	704	364	1,204	504
Liquid sealing compound..	.....	10,395	.....	7,727
Mats and matting	.....	8,993	.....	6,441
Nursing nipples .....gross	283	860	.....	.....
Packing	.....	8,807	.....	7,127
Raincoats .....no.	.....	.....	1,372	11,897
Tire repair material	.....	7,360	.....	.....
Tires, bicycle .....no.	720	786	2,121	1,650
Pneumatic .....no.	113	7,853	69	4,691
Solid, for automobiles and motor trucks no.	22	859	6	297
Other	.....	1,656	.....	819
Other rubber manufactures	.....	169,624	.....	126,633
TOTALS	.....	$ 357,658	.....	$ 271,075
TOTAL RUBBER IMPORTS	.....	$ 680,673	.....	$ 597,401

Exports of Crude and Manufactured Rubber

UNMANUFACTURED				
Crude rubber, including synthetic rubber ....lbs.	1,622,916	$ 420,532	2,077,349	$ 811,758
Waste rubber .....lbs.	2,209,500	33,061	4,107,000	47,315
TOTALS	3,832,416	$ 453,593	6,184,349	$ 859,073
PARTLY MANUFACTURED				
Soling slabs .....lbs.	7,150	$ 1,496	60,020	$ 12,938
MANUFACTURED				
Belting .....lbs.	149,051	$ 90,995	53,234	$ 26,483
Hose	.....	63,442	.....	26,310
Canvas shoes with rubber soles .....prs.	269,887	286,704	21	32
Boots and shoes of rubber n.o.p. .....prs.	217,073	373,356	134,651	295,009
Heels .....prs.	122,820	12,348	231,526	24,315
Soles .....prs.	2,120	558	473,611	190,380
Clothing of rubber and waterproofed clothing ..	.....	4,064	.....	53,408
Insulated wire and cable..	.....	299,878	.....	253,018
Inner tubes .....no.	9,193	33,034	34,165	115,391
Tires, pneumatic .....no.	8,623	171,442	42,197	1,301,718
Other .....no.	1,528	1,971	708	40,754
Other rubber manufactures	.....	24,608	.....	12,249
TOTALS	.....	$1,362,500	.....	$2,339,067
TOTAL RUBBER EXPORTS	.....	$1,817,489	.....	$3,211,078

Moisture Relations

(Continued from page 662)

perature and humidity exert profound influences upon the physical properties of tire cords. These results and the experiments on moisture in tires described in the present paper emphasize the importance of measuring the physical properties of tire cords over a wide range of moisture contents.

The authors are indebted to A. J. Slatter, W. M. Moser, and M. DeMarco of the Armstrong Tire & Rubber Co., Natchez, Miss., for the data on moisture contents of cords in wheel-tested tires, and to E. L. Skau of the Southern Regional Research Laboratory for his interest and encouragement in this work.

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NEW YORK COTTON EXCHANGE WEEK-END CLOSING PRICES

Futures	Nov. 24	Dec. 29	Jan. 5	Jan. 12	Jan. 19	Jan. 26
Feb.	24.09	24.50	24.43	24.43	24.52	25.05
Apr.	23.94	24.61	24.53	24.54	24.64	25.15
June	23.74	24.51	24.42	24.43	24.57	25.10
Aug.	23.41	24.19	24.10	24.15	24.32	24.94
Oct.	22.98	23.72	23.66	23.77	23.97	24.66
Nov.	22.92	23.69	23.62	23.75	23.95	24.62
Jan.	22.85	23.61	23.55	23.70	23.90	24.55

COTTON prices continued their upward climb during January in spite of the many seemingly adverse factors.

The price of March futures opened at 24.61¢ a pound on January 2, then dropped steadily, reaching the low of the month, 24.51¢, on January 8. It then fluctuated until January 16, when prices began their steady upward trend, reaching a high of 25.49¢ on January 28. The market closed at 25.26¢ on January 31.

The 15/16-inch spot middling price recorded on January 2 was 25.23¢ and it held within a narrow range until it hit the low for the month on January 8, of 25.20¢. Prices ranged between 25.20¢ and 25.30¢ until January 16 when they rose steadily to reach a high of 26.17¢ on January 28. The closing price on January 31 was 25.96¢.

The high light of the month was on January 14, when Chester Bowles, OPA Administrator, gave notice to growers that he proposed to establish maximum prices for raw cotton of the 1946 crop. However, if the price of cotton becomes stabilized before 1946 owing to improvement in supply or other reasons, it may not actually be necessary to impose these ceilings. The ceiling proposed is 24.09¢ per pound for 15/16-inch middling cotton for Area I, which includes the western part of North and South Carolina. Fractionally lower ceilings representing location differentials were laid down for other areas. While this announcement was expected to send prices down, the trade merely became cautious for a time. Optimism reigned due to the opposition of the Farm Bloc, which threatens the extention of the life of the OPA if these ceilings are ever put in effect.

Another factor which might be expected to cause prices to drop was the announcement by the Department of Agriculture on January 7 that 650,000 bales of cotton would be offered for sale on a bid basis and an additional 850,000 bales would be offered by the end of March. However while traders showed an inclination to mark time pending issuance of details regarding grade and staple of cotton to be offered, spot men were disappointed that the cotton would not be offered at regular selling prices, and while any cotton not taken on bids will be offered at regular prices, it is generally conceded that good grades will readily be absorbed.

Another stimulating market factor was the request from the British Control Board for an undesignated amount of American cotton through Liverpool merchants, which led to the belief of many that the Liverpool futures market may be reopened shortly.

The State Department reported that America plans to ship cotton to Germany and Japan on a limited scale in order to revive the textile industries of those countries. While no mention was made of the quantity to be shipped, it was reported that the initial shipment to Germany woud amount to about 50,000 bales. The Department also announced that a special international textile group, including three representatives of the American textile industry, had gone to Japan to study the textile industry there. President of Wellington-Sears Co., Harry L. Bailey, H. Wichenden Rose, of American Viscose Co., and Frank Rowe, of the Riverside & Dan River Mills, are the American representatives.

The Bureau of the Census reported that cotton consumed during December, 1945, totaled 738,087 bales, 141,669 bales less than consumed during December, 1944.

William H. Koar, president of the New York Cotton Exchange, said that no single factor was responsible for the move by the Exchange on January 22 increasing the required margin on cotton from $5 to $20 a bale on new contracts, effective January 24. The following day the New Orleans Exchange raised to $10 per bale the minimum margin required on future trading in cotton, which became effective on January 28.

Fabrics

While there was a flurry of selling in the middle of January, the start of the New Year failed to bring any revival of trading. With the forward policy of mills hinging upon the mark-up set on converting, some houses booked production for the first quarter, but many would sell only 30 days ahead.

The statistics for cotton tire cord and fabrics, released January 16 by the Bureau of the Census, show that total production for the first nine months of 1945 was 164,342,000 pounds, compared with 155,831,000 pounds for the same period of 1944. Cotton tire cord (not woven) production for the first nine months of 1945 amounted to 47,851,000 pounds, against 46,670,000 pounds for the same months of 1944. Rayon and nylon tire fabrics (including fuel cell fabrics) production reached 129,239,000 pounds for the first three quarters of 1945, contrasted with 73,889,000 pounds for the corresponding period in 1944.

Imports of rayon tire cord yarn from the United States to Canada amounted to 6,256,697,000 pounds in the first 11 months of 1945, against 2,666,150 pounds imported a year earlier. Imports of this type of yarn are declining, however, owing to the termination of military contracts.

Output of hose cord (tube twist only) in the third quarter of 1945 amounted to 2,523,000 pounds, a decrease from the second quarter when 2,617,000 were produced.

An investigation of the entire rayon and cotton tire cord situation was undertaken by the National Cotton Council sales promotion committee, headed by Senator Williamson. It was asserted that the statistics given out by the WPB on the relative amounts of rayon and cotton tire cord and fabric used for military purposes during the war show little justification for wartime expenditure of federal funds to expand the rayon tire cord and fabric industry for military purposes. According to WPB figures of shipments totaling 154,598,000 pounds of rayon cord and fabric, only 35% was for inter-government use, and 65% for civilian markets. During the same period cotton tire cord and fabric shipments totaled 267,978,000 pounds, of which 28% went into military and other government uses. This was accomplished through the cotton tire cord industry's existing facilities and without subsidized expenditures. The investigators also felt that no justification existed for advertising rayon fabrics as being superior for use in tires. The synthetic industry claims that army and navy tests were unbiased and proved the superiority of its product over cotton.

Buyers are still desperately combing the market in search of gray goods; however the continuing integrated mill operations, due to the pricing situation, the lag in mill operations because of the steady decline in manpower since 1943 and the shorter work week along with the pending strike condition all combine to make the search fruitless.

The price of print cloth 38½-inch, 64x60 has been changed to 9.906¢ a yard. No relief has been forthcoming for raincoat manufacturers, and the trade feels that this condition will continue well into this year.

RECLAIMED RUBBER

THE demand for reclaim was roughly 25% greater than the supply at the first of the year and continues to increase. Reclaimers are operating at maximum capacities, but, owing to inability to work a seven-day week, are producing at approximately 60 to 70% of rated efficiency. This decreased efficiency is also caused in part by the admixture of synthetic and natural rubber scraps with consequent increase in tailings.

The consensus of opinion appears to be that straight synthetic rubber reclaim, properly processed, is the equal in properties and processability of natural rubber reclaim. The increase in time necessary for proper reclaiming of synthetic rubber, with the consequent increase in price, is such that there is a marked reluctance on the part of the industry to process the synthetic rubber. The problem of reclaiming mixtures of natural and syntetic rubber scrap is far from solved, although work is under way on this matter by several of the larger reclaimers.

The increase in inventory of scrap containing some percentages of syn-

Lesson for 1946!



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If you have any problems concerning reclaimed rubber, write us. Our experience covers a span of over 63 years—so there is more than an even chance we can help you.

U. S. RUBBER RECLAIMING COMPANY, INC.

500 FIFTH AVENUE • NEW YORK 18, N. Y. • (Plant at Buffalo, N. Y.)

TRENTON . . . H. M. ROYAL, Inc., 689 Pennington Avenue • TORONTO . . . H. VAN DER LINDE, Ltd., 156 Yonge Street

63 Years Serving the Industry Solely as Reclaimers

thetic rubber has lessened demand on the part of the reclaimers, who seek straight natural rubber scrap with which to blend the mixed material. The only important source of such natural rubber scrap is the pool of pre-war tires still on the roads. Since these tires have in most cases undergone recapping with synthetic rubber, the problem of admixture of the rubbers still remains.

There has been an upswing in the use of synthetic rubber reclaim, especially for new products and those previously restricted, but this movement is slight as yet and has not affected the market.

Foreign demand continues to increase, but reclaimers have been forced to ignore this market in view of their inability to satisfy domestic demand. The large reservoir of tires and other rubber parts held overseas by the Armed Services may do much toward filling this demand if the stockpiles are disposed of abroad.

Reclaimed Rubber Prices

	Sp. Grav.	c per Lb.
Auto Tire		
Black Select	1.16-1.18	7 / 7¼
Acid	1.18-1.22	8 / 8¼
Shoe		
Standard	1.56-1.60	7½ / 7¾
Tubes		
Black	1.19-1.28	11¾ / 12
Gray	1.15-1.26	12½ / 13½
Red	1.15-1.32	12½ / 13
Miscellaneous		
Mechanical blends	1.25-1.50	5 / 6

The above list includes those items or classes only that determine the price bases of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

SCRAP RUBBER

THE problem of satisfactory segregation of synthetic rubber scrap from natural rubber scrap remains of paramount importance, together with the difficulty of finding adequate outlets for synthetic rubber scrap, of which inventories are constantly increasing. Demand is light due to admixture of scrap and large inventories of such mixed scrap by the reclaimers. Even natural rubber tires are not in heavy demand, although available to reclaimers at $17.50 to $18.50 per ton. Reclaimers have been refusing much S.A.G. stock and almost unanimously refuse synthetic rubber scrap, especially peelings. Hardest hit are the tire splitters who must make synthetic tire parts, but have no markets.

The separation of synthetic rubber scrap from natural rubber scrap remains a sore point with the industry owing to the unskilled labor available to scrap dealers, as well as lack of adequate skilled and technical facilities. Adding to the problem are the inconsistencies reported in the acceptance or rejection of scrap shipments on the part of the reclaimers.

The Office of Rubber Reserve, successor to the Rubber Reserve Co., has issued figures showing that approximately 1,109,000 tons of scrap rubber were purchased during the war, of which some 927,000 tons were sold for reclaim. The Office has now some 182,000 tons remaining which is not considered worthy of reclaim and will probably be thrown away. This record is considered good in view of the nature and haste of wartime scrap rubber collections.

Of interest is the problem of disposition of the some 12,000 tons of straight natural rubber scrap available for import from England. The high original f.o.b. price together with the cost of transportation would make the price of this scrap approximately $40 per ton to American reclaimers. If approved by OPA, such a price level would be manifestly discriminatory against American scrap dealers operating under the ceiling price of $18.50 per ton. Representations are being made to the OPA to raise the domestic ceiling price if the importation of the English scrap is approved.

Scrap Rubber Ceilings

	c per Lb.
Inner Tubes†	
Red passenger tubes	7½
Black passenger tubes	6¾
Truck tubes	6½
Tires‡	$ per Short Ton
Mixed passenger tires	20.00
Beadless passenger tires	26.00
Mixed truck tires	20.00
Solid tires	36.00
Peelings†	
No. 1 peelings (natural and synthetic)	52.25
(Recap or retread)	44.41
2 peelings (natural and synthetic)	33.00
(Recap or retread)	28.05
No. 1 light colored (zinc) carcass	57.75
Miscellaneous Items*	
Air brake hose	25.00
Miscellaneous hose	17.00
Rubber boots and shoes	33.00
Black mechanical scrap above 115 sp. gr.	20.00
General household and industrial scrap	15.00

† All consuming centers except Los Angeles.
‡ Akron only.
* All consuming centers.

Rims Approved and Branded by The Tire & Rim Association, Inc.

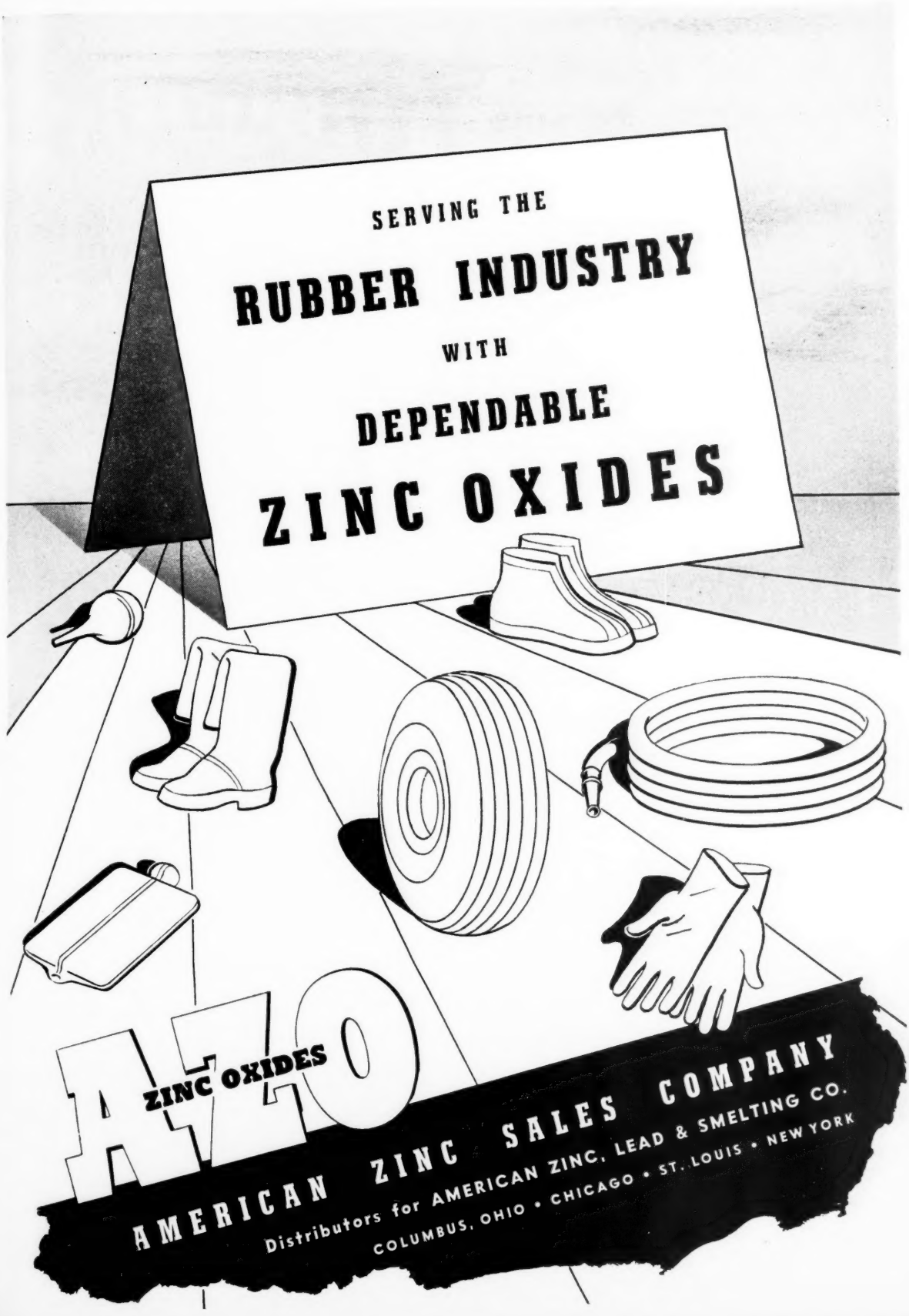
Rim Size	Dec.
15" & 16" D. C. Passenger	1945
16x4.00E	313,313
16x4.25E	73,293
16x4.50E	131,923
15x5.00E	53,217
16x5.00F	6,530
15x5.50F	17,129
16x5.50F	7,095
16x6.00F	11,301
16x4.00E—Hump	46,301
16x4.25E—Hump	8,355
15x4.50E—Hump	13,314
16x6-L	25,237
17" & Over Passenger	
18x2.15B	471
Flat Base Truck	
17x4.33R	4,001
18x4.33R	150
20x4.33R	64,374
15x5.00S	1,660
18x5.00S	929
20x5.00S	211,962
20x6.00T	41,098
24x6.00T	2,415
20x7.33V	72,516
22x7.33V	14,453
24x7.33V	3,619
19x8.37V	215
20x8.37V	429
24x8.37V	346
Semi D. C. Truck	
15x5.50F	7,483
16x5.50F	3,966
Tractor & Implement	
12x2.50C	2,203
12x3.00D	7,639
15x3.00D	23,592
16x3.00D	3,814
18x3.00D	5,234
21x3.25E	396
20x4.50E	891
36x4.50E	534
18x5.50F	667
20x5.50F	7,840
24x6.00S	606
28x6.00S	125
36x6.00S	507
20x8.00T	1,816
24x8.00T	7,450
36x8.00T	551
40x8.00T	605
W8-24	18,217
W9-28	1,186
W10-38	1,105
DW8-38	2,574
DW9-38	13,857
DW10-36	786
DW10-38	13,390
DW11-30	8
DW11-36	638
DW11-38	1,319
DW12-26	3,298
DW12-30	5,516
DW12-34	2,636
Earth Mover	
29x13.00	12
24x15.00	195
TOTAL	1,266,302

Fixed Government Prices*

	Price per Pound: Civilian Use	Other Than Civilian Use
Guayule		
Guayule (carload lots)	$0.17½	$0.31
Latex		
Normal (tank car lots)	.26	.43½
Creamed (tank car lots)	.26¾	.44¼
Centrifuged (tank car lots)	.27¾	.45¼
Heat-Concentrated (carload drums)	.29½	.47
Plantation Grades		
No. 1X Ribbed Smoked Sheets	.22½	.40
1X Thin Pale Latex Crepe	.22½	.40
2 Thick Pale Latex Crepe	.22	.39½
1X Brown Crepe	.21⅜	.38⅞
2X Brown Crepe	.21⅛	.38⅝
2 Remilled Blankets (Amber)	.21¼	.38¾
3 Remilled Blankets (Amber)	.21⅛	.38⅝
Rolled Brown	.18	.35½
Synthetic Rubber		
GR-M (Neoprene GN)	.27½	.45
GR-S (Buna S)	.18½	.36
GR-I (Butyl)	.15½	.33
Wild Rubber		
Upriver Coarse (crude)	.12⅝	.26⅛
(washed and dried)	.20¼	.37¾
Islands Fine (crude)	.14⅝	.28¼
(washed and dried)	.22½	.40
Caucho Ball (crude)	.11⅝	.24¾
(washed and dried)	.19½	.37
Mangabiera (crude)	.08½	.19¾
(washed and dried)	.18	.35½

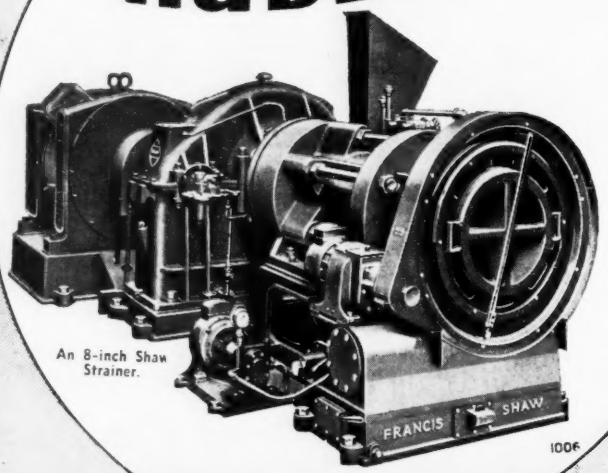
* For a complete list of all grades of all rubbers see Rubber Reserve Co. Circular 17, p. 169, May, 1943, issue.

The National Research Council, in a preliminary report of its work in 1945 issued in Ottawa, Ont., January 4, said that the wartime search for a rubber substitute led to discovery by the Council of a possible substitute for chicle in chewing gum. The report stated that experiments with resin obtained from milkweed leaves were "partially satisfactory" in the hunt for a rubber substitute, "but further study revealed the product might find a more acceptable use as a substitute for chicle in the manufacture of chewing gum."


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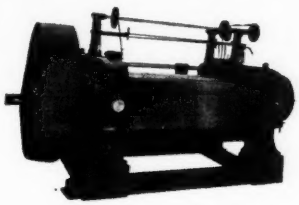
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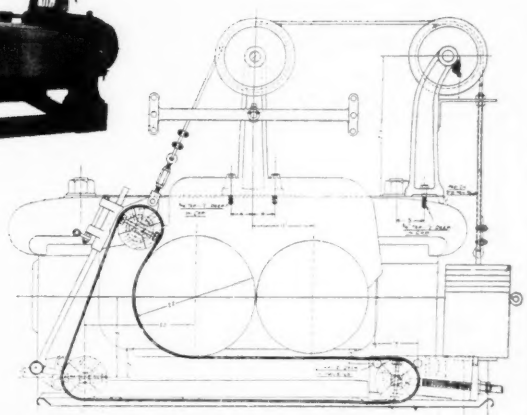
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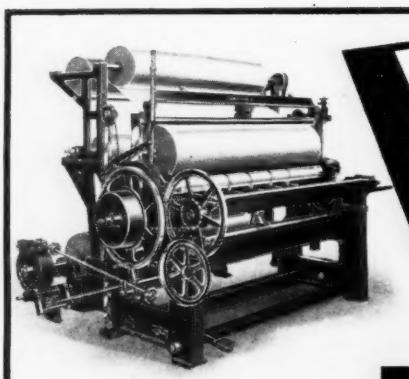


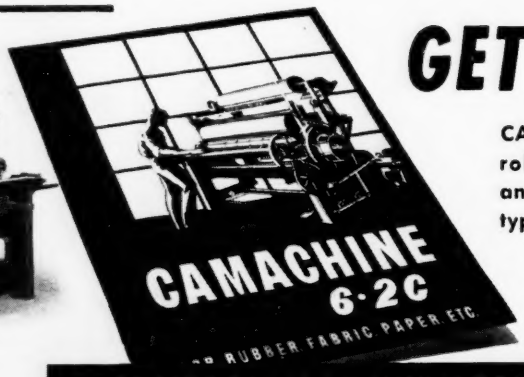


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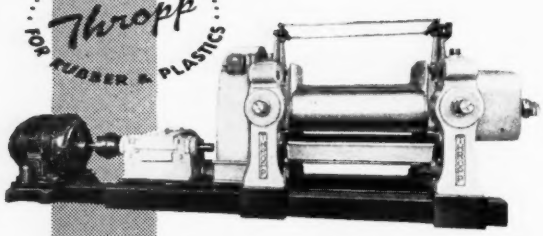
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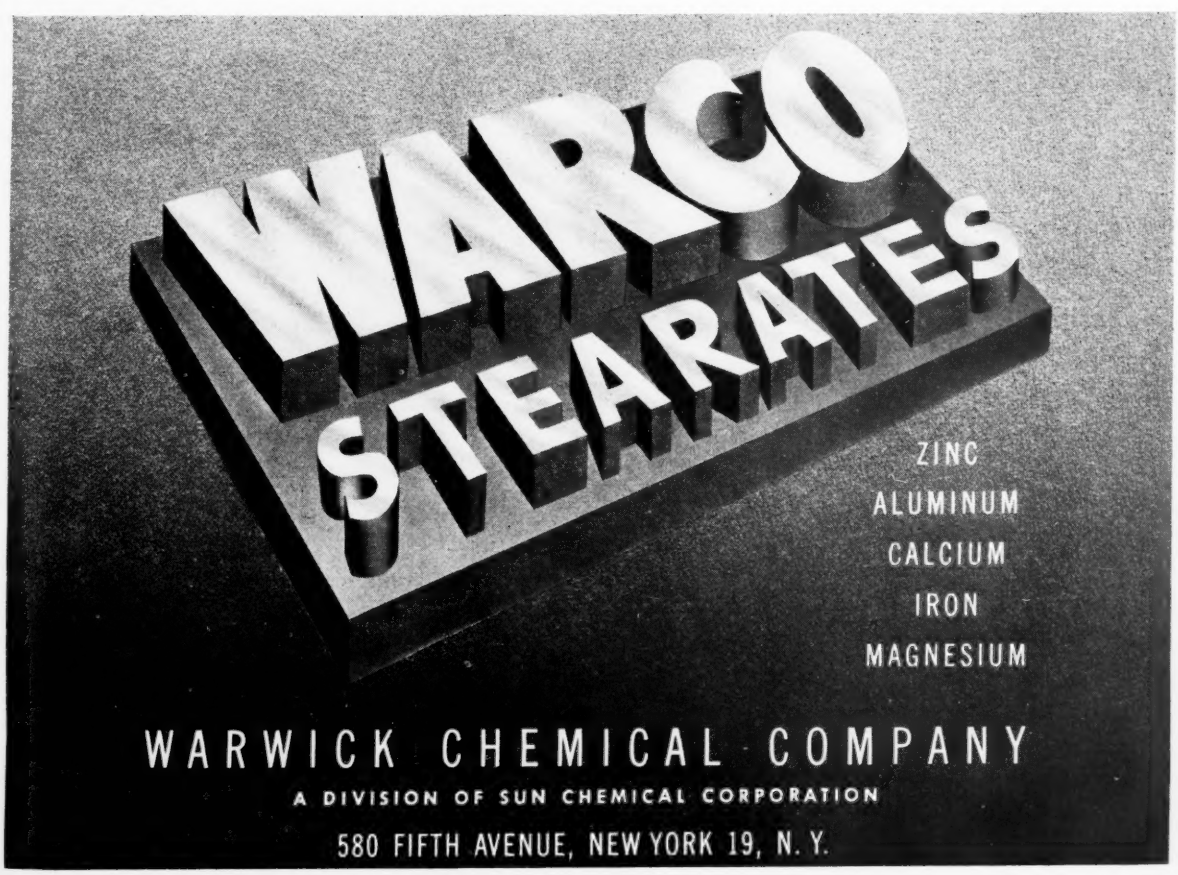
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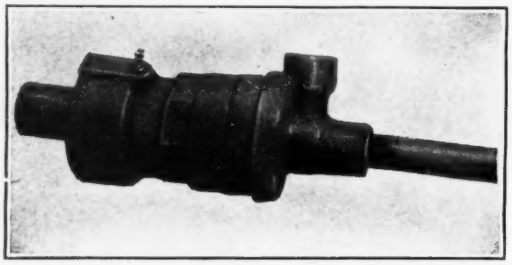
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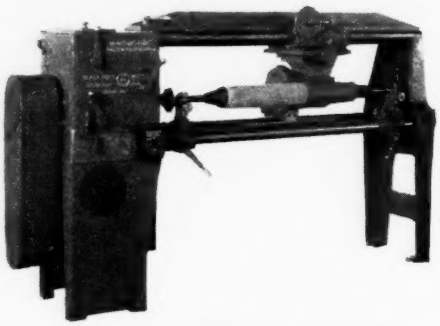
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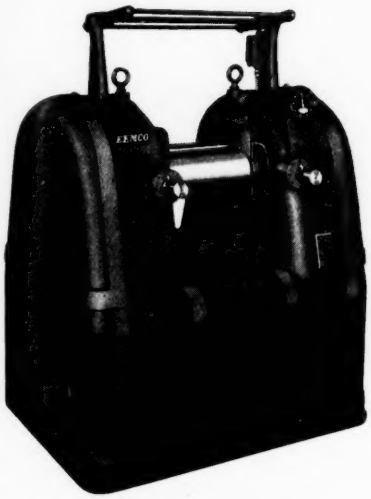
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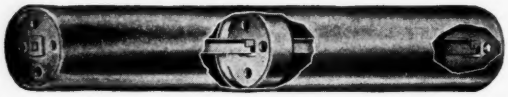
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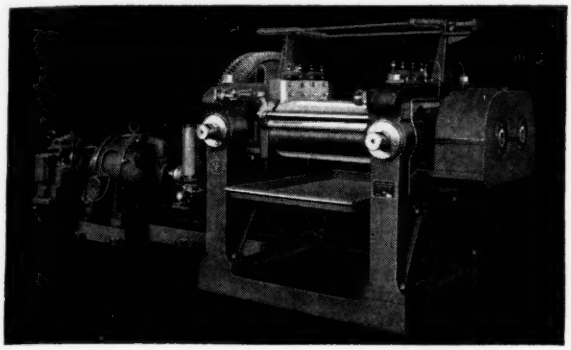
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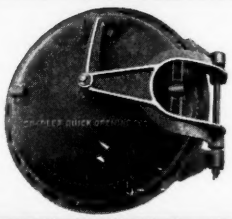


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Development
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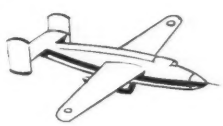
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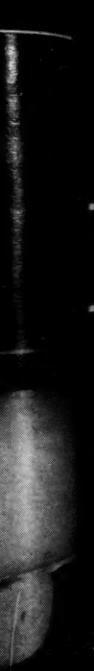
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